



GZA
GeoEnvironmental, Inc.

Engineers and Scientists

September 9, 2014
File No. 02.0171926.00-C, PC

Mr. Charlie Ezequelle
Renaud Bros., Inc.
283 Fort Bridgeman Road #2
Vernon, Vermont 05661

Re: **Dynamic Pile Testing Results – Abutments 1 & 2**
Guilford BRO 1442 (36)
Guilford, Vermont

249 Vanderbilt Avenue
Norwood
Massachusetts
02062
781-278-3700
FAX 781-278-5701
<http://www.gza.com>

Dear Mr. Ezequelle:

This letter summarizes the results of dynamic pile testing performed by GZA GeoEnvironmental, Inc. (GZA) at the above referenced site on September 4, and September 5, 2014. The dynamic pile testing was performed in general accordance with the project specifications and ASTM Method Designation D4945-08, "Standard Test Method for High-Strain Testing of Piles." Dynamic pile testing was performed to measure driving stresses in the test piles, evaluate hammer performance, and verify the driving criterion determined by the WEAP analyses.

Testing was performed on three (3) HP14x89 Grade 50 steel piles located in the Abutment substructures. The required nominal resistance of 332 kips is based upon dividing the maximum factored load of 216 kips by a performance factor of 0.65. The allowable driving stress for Grade 50 steel is 45 ksi (i.e. $0.9f_y$). Each test pile was monitored during initial drive and restrike following a setup period of 24 hours. We understand that the Engineer modified the required setup period to 24 hours due to project schedule restrictions.

The APE D19-42 is a single acting diesel hammer with a ram weight of 4,189 lbs. and a maximum rated stroke of 11.3 feet, yielding a maximum rated energy of 47,335 ft-lbs. The APE D19-42 is equipped with a ratchet style fuel pump with four settings. The fuel pump settings are designed to limit the ram stroke to 5.4 feet, 7.6 feet, 9.0 feet, and 11.4 feet (open) yielding rated energies of 22,721 foot-lbs., 31,715 foot-lbs., 37,868 foot-lbs., and 47,335 foot-lbs., respectively. Based on the results of our WEAP analysis submittal dated March 31, 2014, the test piles were impact driven with the APE D19-42 operating on fuel setting 2 (7.6 foot rated stroke). The hammer cushioning material reportedly consisted of 2 inches of aluminum and conbest.

The PDA was used to make dynamic force and acceleration measurements of the tested piles. These measurements were evaluated in the field to determine pile capacity, pile stress and hammer performance. PDA summary sheets and plots of select averaged PDA parameters versus depth or blow number are attached and summarized in Table 1.

RESULTS

Abutment 2 Pile 1

Abutment 2 Pile 1 developed a “Case Method” pile capacity of 390 kips at a pile penetration of 34.7 feet (tip elevation +1,019.3 feet) and a reported pile penetration resistance of 9-9-10 blows per inch for the final three inches of pile penetration with the APE D19-42 operating on fuel setting 2 (rated 7.6 foot ram stroke) and providing a 7.3 foot ram stroke. Subsequent CAPWAP analyses performed on the dynamic test data from the end of drive indicated an ultimate pile capacity of 400 kips with 160 kips (40 percent) as skin friction and 240 kips (60 percent) as end bearing.



Abutment 2 Pile 1 was monitored during restrike after a setup period of approximately 24 hours. Dynamic measurements obtained during restrike indicated that Pile 1 developed a “Case Method” ultimate pile capacity of 440 kips at a reported penetration resistance of 8 blows per inch with the APE D19-42 operating on fuel setting 2 (rated 7.6 foot ram stroke) and providing an 8.9 foot ram stroke. Subsequent CAPWAP analyses performed on the dynamic test data from the beginning of restrike indicated an ultimate pile capacity of 460 kips with 230 kips (50 percent) as skin friction and 230 kips (50 percent) as end bearing.

Abutment 2 Pile 2

Abutment 2 Pile 2 developed a “Case Method” pile capacity of 370 kips at a pile penetration of 34.5 feet (tip elevation +1,019.5 feet) and a reported pile penetration resistance of 6-6-8 blows per inch for the final three inches of pile penetration with the APE D19-42 operating on fuel setting 2 (rated 7.6 foot ram stroke) and providing a 7.6 foot ram stroke. Subsequent CAPWAP analyses performed on the dynamic test data from the end of drive indicated an ultimate pile capacity of 390 kips with 220 kips (56 percent) as skin friction and 170 kips (44 percent) as end bearing.

Abutment 2 Pile 2 was monitored during restrike after a setup period of approximately 24 hours. Dynamic measurements obtained during restrike indicated that Pile 2 developed a “Case Method” ultimate pile capacity of 440 kips at a reported penetration resistance of 9 blows per inch with the APE D19-42 operating on fuel setting 2 (rated 7.6 foot ram stroke) and providing an 9.1 foot ram stroke. Subsequent CAPWAP analyses performed on the dynamic test data from the beginning of restrike indicated an ultimate pile capacity of 460 kips with 300 kips (65 percent) as skin friction and 160 kips (35 percent) as end bearing.

Abutment 1 Pile 5

Abutment 1 Pile 5 developed a “Case Method” pile capacity of 310 kips at a pile penetration of 27.6 feet (tip elevation +1,027.4 feet) and a reported pile penetration resistance of 6-7-6 blows per inch for the final three inches of pile penetration with the APE D19-42 operating on fuel setting 2 (rated 7.6 foot ram stroke) and providing a 6.9 foot ram stroke. Subsequent CAPWAP analyses performed on the dynamic test data from the end of drive indicated an ultimate pile capacity of 320 kips with 70 kips (22 percent) as skin friction and 250 kips (78 percent) as end bearing.

Abutment 1 Pile 5 was monitored during restrike after a setup period of approximately 24 hours. Dynamic measurements obtained during restrike indicated that Pile 5 developed a “Case Method” ultimate pile capacity of 360 kips at a reported penetration resistance of 7 blows per inch with the APE D19-42 operating on fuel setting 2 (rated 7.6 foot ram stroke) and providing an 7.9 foot ram stroke. Subsequent CAPWAP analyses performed on the dynamic test data from the beginning of restrike indicated an ultimate pile capacity of 370 kips with 120 kips (32 percent) as skin friction and 250 kips (68 percent) as end bearing.

DISCUSSION

The information provided in the Project Documents indicates that the piles were designed to achieve a minimum pile penetration of 25 feet and develop end bearing on bedrock. Based on GZA’s review of the project borings, it appears that each test pile developed the required “Case Method” nominal resistance in the underlying weathered bedrock at a subsurface penetration of greater than 25 feet. GZA’s analysis of the field results of Abutment 1 Pile 5 indicated a pile capacity slightly less than the required nominal resistance of 332 kips. Given Abutment 1 Pile 5 did not achieve the require capacity and did not appear to demonstrate bearing on competent bedrock, the Engineer recommended that all the test piles be monitored during restrike to evaluate time-dependent pile capacity.

The restrike dynamic test results indicated that each test pile developed the required nominal resistance and the CAPWAP results suggest a 15 percent to 18 percent increase in pile resistance.

Based on observation of the pile installation, evaluation of project borings, and review of the dynamic pile test results, we understand that the Engineer developed the driving criterion of 7 blows per inch for the final three inches of pile penetration with the APE D19-42 operating on fuel setting 2 and providing a minimum 7.0 foot ram stroke.



LIMITATIONS

This report has been prepared for specific application to the Guilford BRO 1442(36) Bridge project in Guilford, Vermont in accordance with generally accepted soil and foundation practice. The static resistance values computed with the "Case Method" and from CAPWAP analysis are estimates of the mobilized axial compressive soil capacity at the time of testing. These soil resistance results are ultimate resistance values and they must be reduced by an appropriate factor of safety or resistance factor to obtain working or factored compressive loads. Any driving criterion determined from the above data assumes consistent hammer performance in terms of both ram stroke and transfer energy. Piles demonstrating driving characteristics different from the tested piles may require additional testing to confirm the developed pile capacity. Services not provided on this project by GZA (such as logging pile resistance (blow counts during driving)) are reported herein only as it applies to the pile testing accomplished. No other warranty, expressed or implied, is made.

If you have any further questions, please contact either of the undersigned.

Very truly yours,
GZA GEOENVIRONMENTAL, INC.

A handwritten signature in blue ink that appears to read "Michael J. Deery".

Michael J. Deery
Project Engineer

A handwritten signature in blue ink that appears to read "Bradford W. Roberts". Below the signature, there is a small "for" written vertically.

Bradford W. Roberts
Consultant/Reviewer

A handwritten signature in blue ink that appears to read "John E. Regan".

John E. Regan
Principal

Attachments: PDA Summary Data Table
PDA Field Data
CAPWAP Analyses
Pile Installation Logs

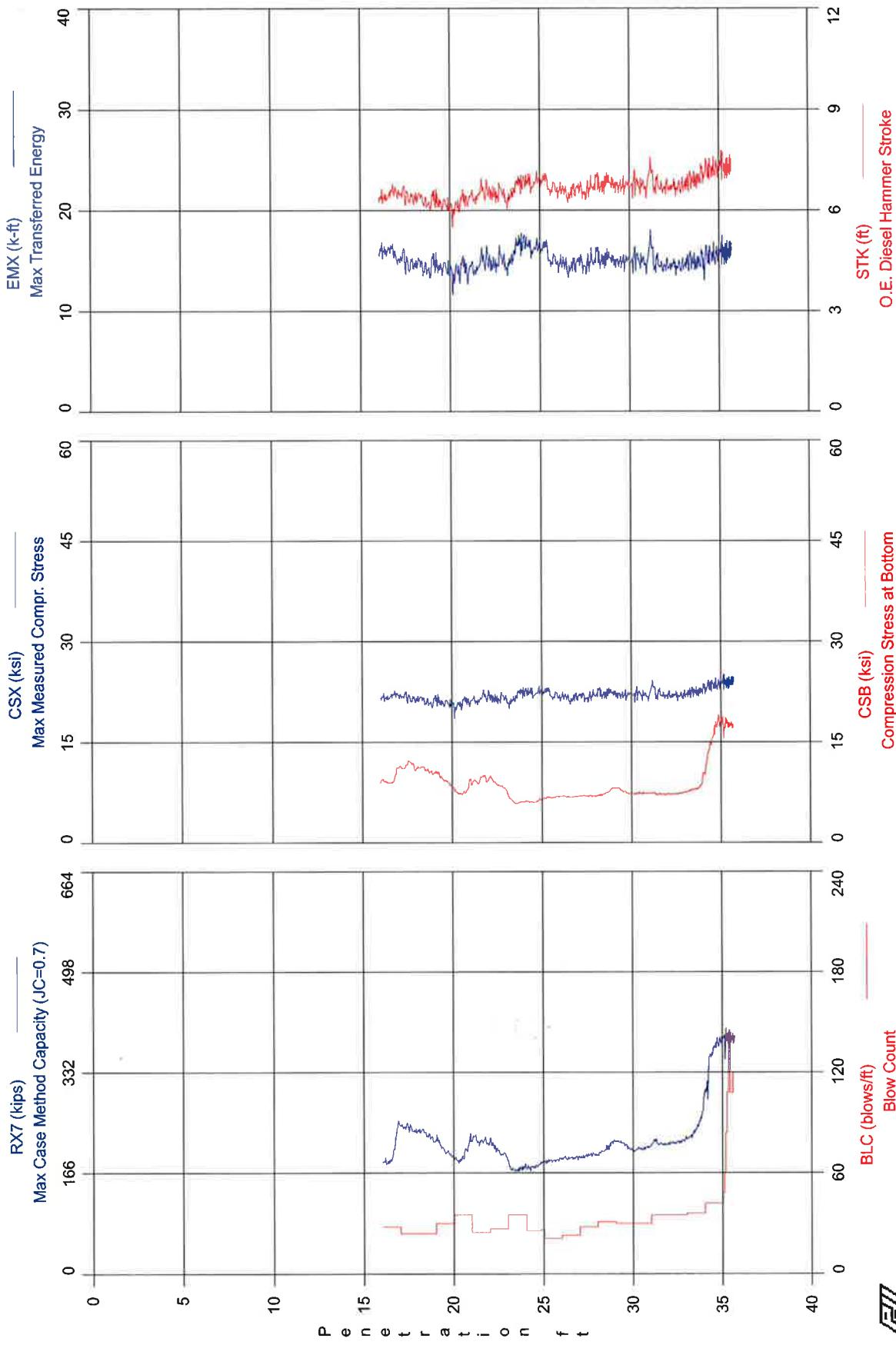
TABLE 1
GUILFORD BRO 1442(36)
DYNAMIC PILE TESTING RESULTS
GUILFORD, VERMONT

| ABUTMENT | PILE NO. | DATE TESTED | TEST TYPE ⁴ | BLOW COUNT ³ (bpi) | PILE PENETRATION (ft) | TIP ELEVATION (ft) | RAM STROKE (ft) | TRANSFER ENERGY ⁵ (kip-ft) | PILE STRESS ⁶ At Butt (ksi) | PILE STRESS ⁶ At Tip (ksi) | PDA ⁷ | | CAPWAP ⁸ | |
|----------|----------|-------------|------------------------|----------------------------------|-----------------------|--------------------|-----------------|---------------------------------------|--|---------------------------------------|-----------------------|-----------------------|----------------------------|--------------------|
| | | | | | | | | | | | TOTAL CAPACITY (kips) | TOTAL CAPACITY (kips) | TOTAL SKIN FRICTION (kips) | END BEARING (kips) |
| 2 | 1 | 9/4/14 | EOD | 9-9-10 3 bpi | 34.7 | + 1019.3 | 7.3 | 15.9 | 24.0 | 17.4 | 390 | 400 | 160 | 240 |
| | 2 | 9/5/14 | EOD | 6-6-8 9 bpi | 34.5 | + 1019.5 | 7.6 | 16.2 | 24.4 | 17.3 | 370 | 390 | 230 | 230 |
| 1 | 5 | 9/4/14 | EOD | 6-7-6 7 bpi | 27.6 | + 1027.4 | 6.9 | 13.9 | 22.1 | 12.7 | 310 | 320 | 70 | 170 |
| | 1 | 9/4/14 | BOR | | | | 7.9 | 18.0 | 26.3 | 16.8 | 360 | 370 | 120 | 160 |

Notes :

1. Test pile is HP14x89 Grade 50 steel pile driven with an APE D19-42 single acting diesel impact hammer operating on fuel setting 2.
2. The specified nominal resistance is 332 kips.
3. Blow counts were reported by others.
4. Test type is defined as: EOD = end of drive, BOR = beginning of restrike.
5. Transferred Energy is the delivered hammer energy to the pile measured at the PDA sensors.
6. Pile Stress is the maximum force delivered to the pile divided by the pile area, measured at the sensor location.
7. PDA Total Capacity is the ultimate pile capacity predicted at the time of testing including skin and endbearing resistance.
8. CAPWAP Total Capacity, Skin Friction and End Bearing are derived from CAPWAP analysis and are reported as ultimate pile capacity.
9. File penetration is referenced to the subgrade elevation +1,054.0 and +1055.0 for Abutment 2 and Abutment 1, respectively.

GUILFORD BRO 1442(36) - ABUTMENT 2 PILE 1 ID -APE D19-42 (HP14X89)



GUILFORD BRO 1442(36) - ABUTMENT 2 PILE 1 ID
OP: CAG

APE D19-42 (HP14X89)
Test date: 4-Sep-2014

AR: 26.10 in^2
LE: 54.50 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.35

RX7: Max Case Method Capacity (JC=0.7)
CSX: Max Measured Compr. Stress
CSB: Compression Stress at Bottom

EMX: Max Transferred Energy
STK: O.E. Diesel Hammer Stroke
FVP: Force/Velocity proportionality

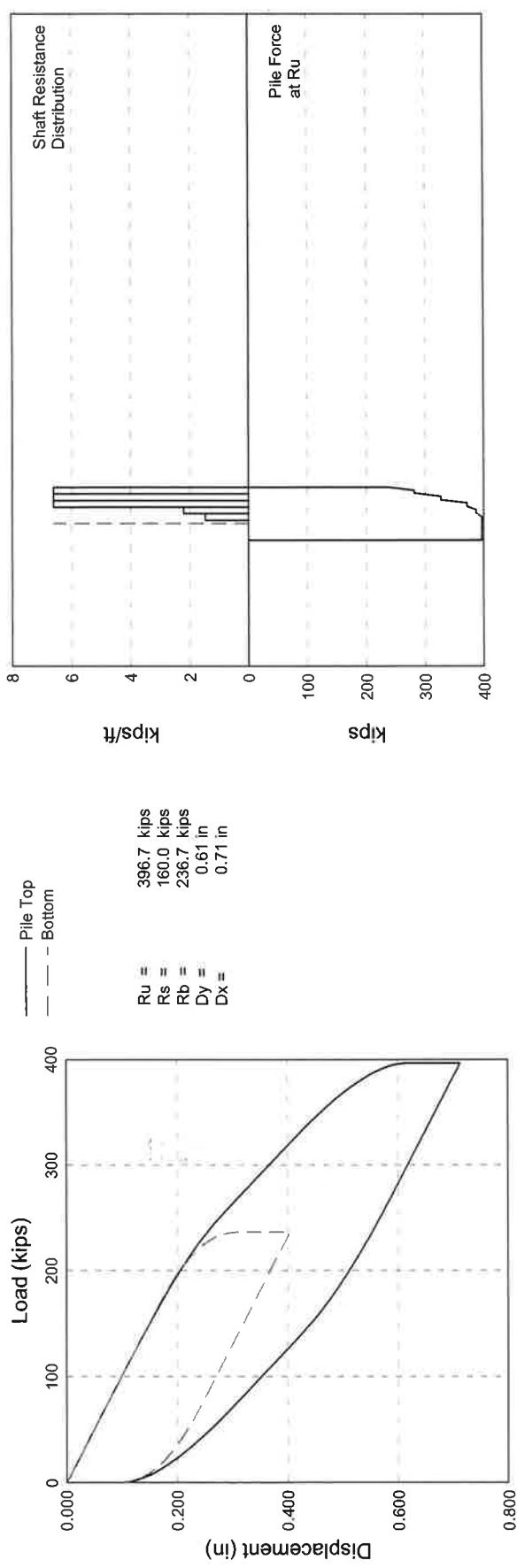
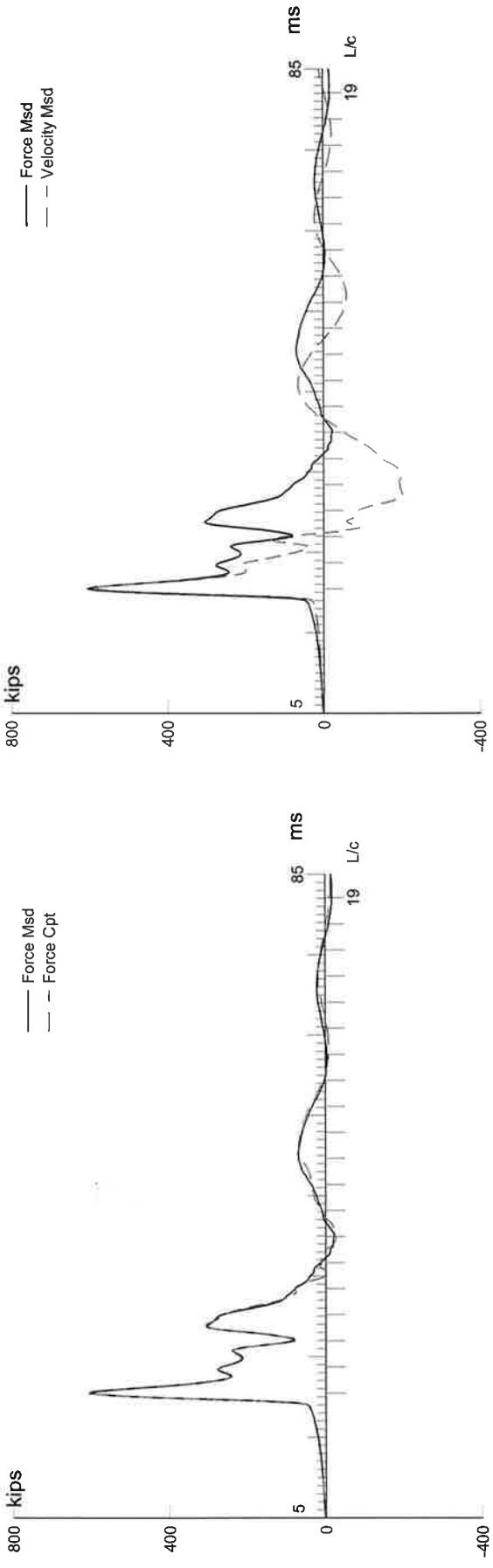
| BL# | depth | BLC | TYPE | RX7 | CSX | CSB | EMX | STK | FVP |
|-----|-------|-------|------|------|------|------|------|------|------|
| end | ft | bl/ft | | kips | ksi | ksi | k-ft | ft | [] |
| 29 | 17.00 | 28 | AV28 | 203 | 21.9 | 9.5 | 15.9 | 6.46 | 0.99 |
| 53 | 18.00 | 24 | AV24 | 241 | 21.7 | 11.5 | 14.9 | 6.45 | 0.98 |
| 77 | 19.00 | 24 | AV24 | 230 | 21.2 | 11.0 | 14.4 | 6.31 | 0.97 |
| 107 | 20.00 | 30 | AV30 | 206 | 21.0 | 9.6 | 14.4 | 6.24 | 0.98 |
| 142 | 21.00 | 35 | AV35 | 199 | 20.7 | 7.8 | 13.9 | 6.18 | 0.98 |
| 167 | 22.00 | 25 | AV25 | 220 | 21.5 | 9.4 | 14.6 | 6.47 | 0.98 |
| 194 | 23.00 | 27 | AV27 | 204 | 21.7 | 8.9 | 15.0 | 6.55 | 0.97 |
| 229 | 24.00 | 35 | AV35 | 174 | 21.7 | 6.4 | 15.6 | 6.56 | 0.98 |
| 255 | 25.00 | 26 | AV26 | 177 | 22.4 | 6.3 | 16.5 | 6.85 | 0.98 |
| 276 | 26.00 | 21 | AV21 | 187 | 22.2 | 6.8 | 15.6 | 6.77 | 0.98 |
| 299 | 27.00 | 23 | AV23 | 192 | 21.6 | 7.0 | 14.5 | 6.55 | 0.98 |
| 327 | 28.00 | 28 | AV28 | 196 | 21.8 | 7.1 | 14.7 | 6.64 | 0.98 |
| 358 | 29.00 | 31 | AV31 | 208 | 22.3 | 7.5 | 15.2 | 6.83 | 0.97 |
| 388 | 30.00 | 30 | AV30 | 213 | 22.1 | 7.8 | 15.0 | 6.76 | 0.97 |
| 418 | 31.00 | 30 | AV30 | 206 | 22.0 | 7.3 | 15.0 | 6.74 | 0.98 |
| 453 | 32.00 | 35 | AV32 | 215 | 22.4 | 7.3 | 15.1 | 6.83 | 0.97 |
| 488 | 33.00 | 35 | AV35 | 217 | 22.0 | 7.3 | 14.5 | 6.70 | 0.97 |
| 524 | 34.00 | 36 | AV36 | 244 | 22.5 | 8.1 | 14.8 | 6.88 | 0.97 |
| 566 | 35.00 | 42 | AV40 | 363 | 23.4 | 15.3 | 15.5 | 7.21 | 0.97 |
| 570 | 35.08 | 48 | AV4 | 390 | 23.9 | 18.2 | 15.9 | 7.34 | 0.97 |
| 575 | 35.17 | 60 | AV3 | 378 | 24.6 | 17.7 | 16.3 | 7.63 | 0.97 |
| 582 | 35.25 | 84 | AV7 | 391 | 24.0 | 16.9 | 16.0 | 7.34 | 0.98 |
| 591 | 35.33 | 108 | AV9 | 389 | 23.6 | 18.0 | 15.5 | 7.17 | 0.97 |
| 603 | 35.42 | 144 | AV12 | 390 | 23.8 | 17.8 | 15.8 | 7.26 | 0.97 |
| 612 | 35.50 | 108 | AV9 | 387 | 23.8 | 17.5 | 15.7 | 7.24 | 0.97 |
| 621 | 35.58 | 108 | AV9 | 389 | 23.9 | 17.7 | 15.9 | 7.26 | 0.97 |
| 631 | 35.67 | 120 | AV10 | 385 | 24.0 | 17.4 | 15.9 | 7.30 | 0.97 |

Time Summary

Drive 23 minutes 57 seconds 2:16:35 PM - 2:40:32 PM (9/4/2014) BN 1 - 632

GUILFORD BRO 1442(36); Pile: ABUTMENT 2 PILE 1 ID; APE D19-42 (HP14X89); Blow: 626 (Test: 04-Sep-2014 14:40:)
 GZA GeoEnvironmental Inc.

08-Sep-2014
 CAPWAP(R) 2006-3



GUILFORD BRO 1442(36); Pile: ABUTMENT 2 PILE 1 ID
APE D19-42 (HP14X89); Blow: 626
GZA GeoEnvironmental Inc.

Test: 04-Sep-2014 14:40:
CAPWAP(R) 2006-3
OP: CAG

CAPWAP SUMMARY RESULTS

| Total CAPWAP Capacity: 396.7; along Shaft | | | | 160.0; at Toe | 236.7 kips | | | |
|---|----------------------|----------------------|---|--------------------|----------------|------------------------------|-------------------------|---------------------------|
| Soil Sgmnt No. | Dist. Below Gages ft | Depth Below Grade ft | Ru in Pile kips | Force in Pile kips | Sum of Ru kips | Unit Resist. (Depth) kips/ft | Unit Resist. (Area) ksf | Smith Damping Factor s/ft |
| | | | | 396.7 | | | | |
| 1 | 27.3 | 7.3 | 10.0 | 386.7 | 10.0 | 1.36 | 0.29 | 0.114 |
| 2 | 34.1 | 14.1 | 15.0 | 371.7 | 25.0 | 2.20 | 0.47 | 0.114 |
| 3 | 40.9 | 21.0 | 45.0 | 326.7 | 70.0 | 6.61 | 1.42 | 0.114 |
| 4 | 47.7 | 27.8 | 45.0 | 281.7 | 115.0 | 6.61 | 1.42 | 0.114 |
| 5 | 54.5 | 34.6 | 45.0 | 236.7 | 160.0 | 6.61 | 1.42 | 0.114 |
| Avg. Shaft | | | 32.0 | | 4.63 | | 0.99 | 0.114 |
| Toe | | | 236.7 | | | 173.90 | | 0.057 |
| Soil Model Parameters/Extensions | | | | | Shaft | Toe | | |
| Quake | (in) | | | | 0.080 | 0.235 | | |
| Case Damping Factor | | | | | 0.391 | 0.290 | | |
| Unloading Quake | (% of loading quake) | | | | 87 | 52 | | |
| Reloading Level | (% of Ru) | | | | 100 | 100 | | |
| Unloading Level | (% of Ru) | | | | 30 | | | |
| CAPWAP match quality | = | 2.12 | (Wave Up Match) ; RSA = 0 | | | | | |
| Observed: final set | = | 0.100 in; | blow count = 120 b/ft | | | | | |
| Computed: final set | = | 0.096 in; | blow count = 125 b/ft | | | | | |
| max. Top Comp. Stress | = | 23.5 ksi | (T= 20.9 ms, max= 1.044 x Top) | | | | | |
| max. Comp. Stress | = | 24.5 ksi | (Z= 40.9 ft, T= 23.1 ms) | | | | | |
| max. Tens. Stress | = | -2.92 ksi | (Z= 34.1 ft, T= 39.7 ms) | | | | | |
| max. Energy (EMX) | = | 14.6 kip-ft; | max. Measured Top Displ. (DMX)= 0.51 in | | | | | |

GUILFORD BRO 1442(36); Pile: ABUTMENT 2 PILE 1 ID
APE D19-42 (HP14X89); Blow: 626
GZA GeoEnvironmental Inc.

Test: 04-Sep-2014 14:40:
CAPWAP(R) 2006-3
OP: CAG

| EXTREMA TABLE | | | | | | | | | |
|----------------|----------------------|-----------------|-----------------|-----------------------|-----------------------|----------------------------|------------------|----------------|--|
| Pile Sgmnt No. | Dist. Below Gages ft | max. Force kips | min. Force kips | max. Comp. Stress ksi | max. Tens. Stress ksi | max. Trnsfd. Energy kip-ft | max. Veloc. ft/s | max. Displ. in | |
| 1 | 3.4 | 612.3 | -33.1 | 23.5 | -1.27 | 14.62 | 12.6 | 0.496 | |
| 2 | 6.8 | 612.9 | -40.0 | 23.5 | -1.53 | 14.55 | 12.5 | 0.487 | |
| 3 | 10.2 | 613.6 | -46.7 | 23.5 | -1.79 | 14.43 | 12.5 | 0.475 | |
| 4 | 13.6 | 614.4 | -52.0 | 23.5 | -1.99 | 14.26 | 12.5 | 0.461 | |
| 5 | 17.0 | 615.6 | -56.4 | 23.6 | -2.16 | 14.06 | 12.4 | 0.445 | |
| 6 | 20.4 | 619.0 | -63.6 | 23.7 | -2.44 | 13.88 | 12.3 | 0.430 | |
| 7 | 23.8 | 624.7 | -69.0 | 23.9 | -2.64 | 13.71 | 12.2 | 0.415 | |
| 8 | 27.3 | 631.9 | -73.0 | 24.2 | -2.80 | 13.52 | 12.0 | 0.400 | |
| 9 | 30.7 | 616.8 | -74.4 | 23.6 | -2.85 | 12.76 | 11.8 | 0.384 | |
| 10 | 34.1 | 631.7 | -76.3 | 24.2 | -2.92 | 12.51 | 11.5 | 0.366 | |
| 11 | 37.5 | 619.1 | -69.8 | 23.7 | -2.67 | 11.51 | 11.1 | 0.348 | |
| 12 | 40.9 | 639.2 | -70.7 | 24.5 | -2.71 | 11.22 | 10.6 | 0.330 | |
| 13 | 44.3 | 551.7 | -52.4 | 21.1 | -2.01 | 9.05 | 10.5 | 0.313 | |
| 14 | 47.7 | 512.9 | -55.7 | 19.6 | -2.13 | 8.85 | 11.9 | 0.297 | |
| 15 | 51.1 | 354.2 | -39.0 | 13.6 | -1.49 | 6.86 | 12.5 | 0.284 | |
| 16 | 54.5 | 387.4 | -37.9 | 14.8 | -1.45 | 5.41 | 12.1 | 0.269 | |
| Absolute | | 40.9 | | 24.5 | | | (T = 23.1 ms) | | |
| | | 34.1 | | | -2.92 | | (T = 39.7 ms) | | |

| CASE METHOD | | | | | | | | | | |
|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| J = | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| RP | 592.1 | 530.3 | 468.5 | 406.7 | 344.9 | 283.2 | 221.4 | 159.6 | 97.8 | 36.0 |
| RX | 604.5 | 544.5 | 488.3 | 446.3 | 429.7 | 413.3 | 399.1 | 390.3 | 383.3 | 377.5 |
| RU | 604.5 | 543.1 | 481.7 | 420.4 | 359.0 | 297.6 | 236.2 | 174.9 | 113.5 | 52.1 |

RAU = 332.0 (kips); RA2 = 405.9 (kips)

Current CAPWAP Ru = 396.7 (kips); Corresponding J(RP) = 0.32; J(RX) = 0.63

| VMX ft/s | TVP ms | VT1*Z kips | FT1 kips | FMX kips | DMX in | DFN in | SET in | EMX kip-ft | QUS kips |
|----------|--------|------------|----------|----------|--------|--------|--------|------------|----------|
| 13.03 | 20.67 | 595.8 | 614.2 | 614.2 | 0.511 | 0.100 | 0.100 | 14.8 | 581.2 |

PILE PROFILE AND PILE MODEL

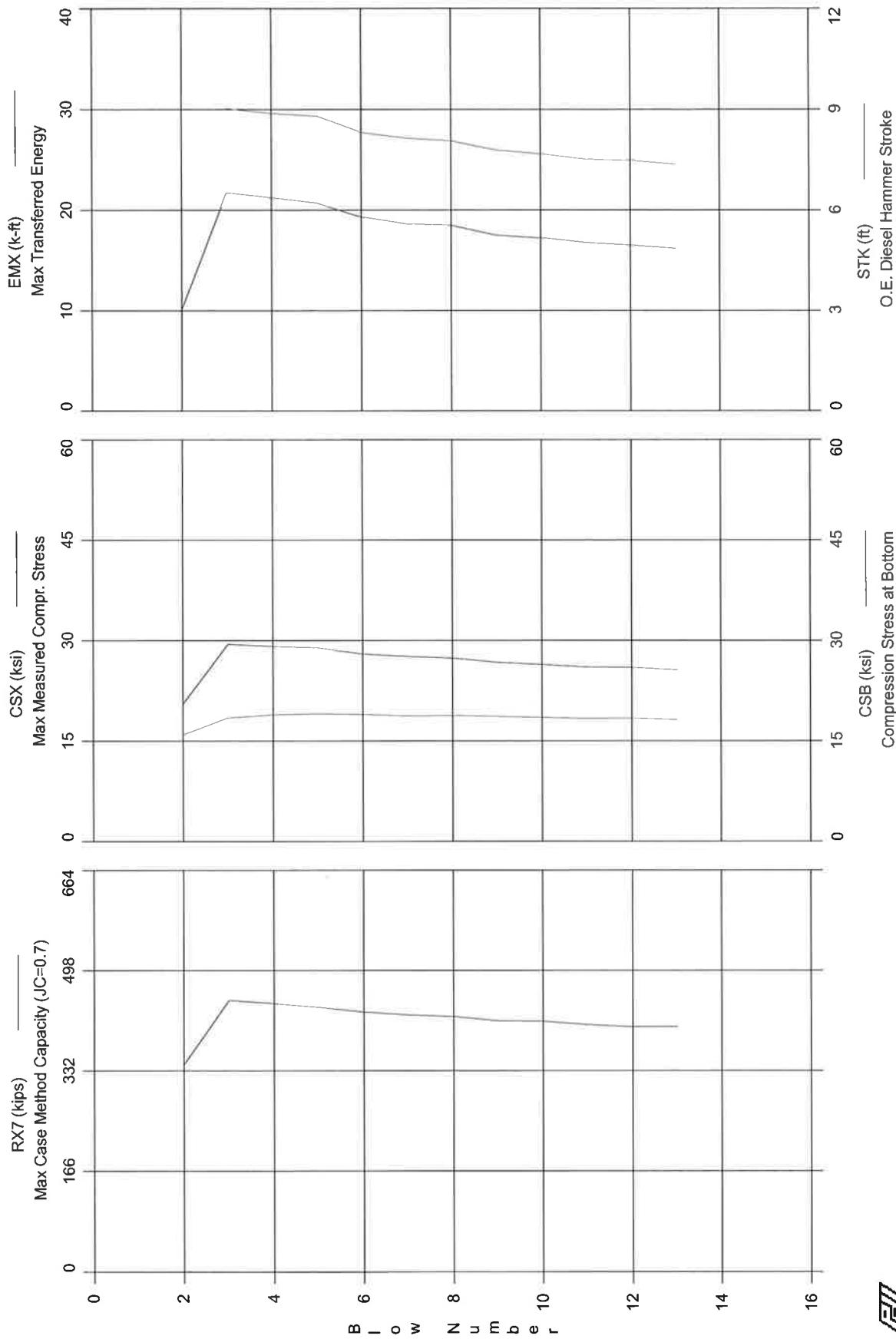
| Depth ft | Area in ² | E-Modulus ksi | Spec. Weight lb/ft ³ | Perim. ft |
|----------|----------------------|---------------|---------------------------------|-----------|
| 0.00 | 26.10 | 29992.2 | 492.000 | 4.667 |
| 54.50 | 26.10 | 29992.2 | 492.000 | 4.667 |

Toe Area 1.361 ft²

Top Segment Length 3.41 ft, Top Impedance 46.59 kips/ft/s

Pile Damping 1.0 %, Time Incr 0.203 ms, Wave Speed 16807.9 ft/s, 2L/c 6.5 ms

GUILFORD BRO 1442(36) - ABUTMENT 2 PILE 1 RS - APE D19-42 (HP14X89)



GUILFORD BRO 1442(36) - ABUTMENT 2 PILE 1 RS
OP: JAH

APE D19-42 (HP14X89)
Test date: 5-Sep-2014

AR: 26.10 in²
LE: 54.50 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.50

| | |
|--|-------------------------------------|
| RX7: Max Case Method Capacity (JC=0.7) | EMX: Max Transferred Energy |
| CSX: Max Measured Compr. Stress | STK: O.E. Diesel Hammer Stroke |
| CSB: Compression Stress at Bottom | FVP: Force/Velocity proportionality |

| BL# | RX7 kips | CSX ksi | CSB ksi | EMX k-ft | STK ft | FVP [] |
|---------|-------------|------------|------------|-------------|-----------|------------|
| 2 | 343 | 20.6 | 15.9 | 10.1 | 0.00 | 1.01 |
| 3 | 448 | 29.4 | 18.4 | 21.7 | 9.03 | 1.00 |
| 4 | 443 | 29.1 | 18.9 | 21.2 | 8.89 | 1.00 |
| 5 | 437 | 28.9 | 19.1 | 20.7 | 8.79 | 1.00 |
| 6 | 429 | 28.0 | 19.0 | 19.3 | 8.31 | 1.00 |
| 7 | 424 | 27.6 | 18.7 | 18.6 | 8.15 | 1.00 |
| 8 | 421 | 27.4 | 18.8 | 18.5 | 8.07 | 1.00 |
| 9 | 414 | 26.7 | 18.7 | 17.5 | 7.79 | 1.00 |
| 10 | 414 | 26.4 | 18.5 | 17.2 | 7.68 | 1.00 |
| 11 | 408 | 26.0 | 18.3 | 16.7 | 7.53 | 1.00 |
| 12 | 404 | 25.9 | 18.4 | 16.5 | 7.49 | 1.00 |
| 13 | 405 | 25.6 | 18.2 | 16.1 | 7.39 | 1.00 |
| Average | 416 | 26.8 | 18.4 | 17.8 | 8.10 | 1.00 |

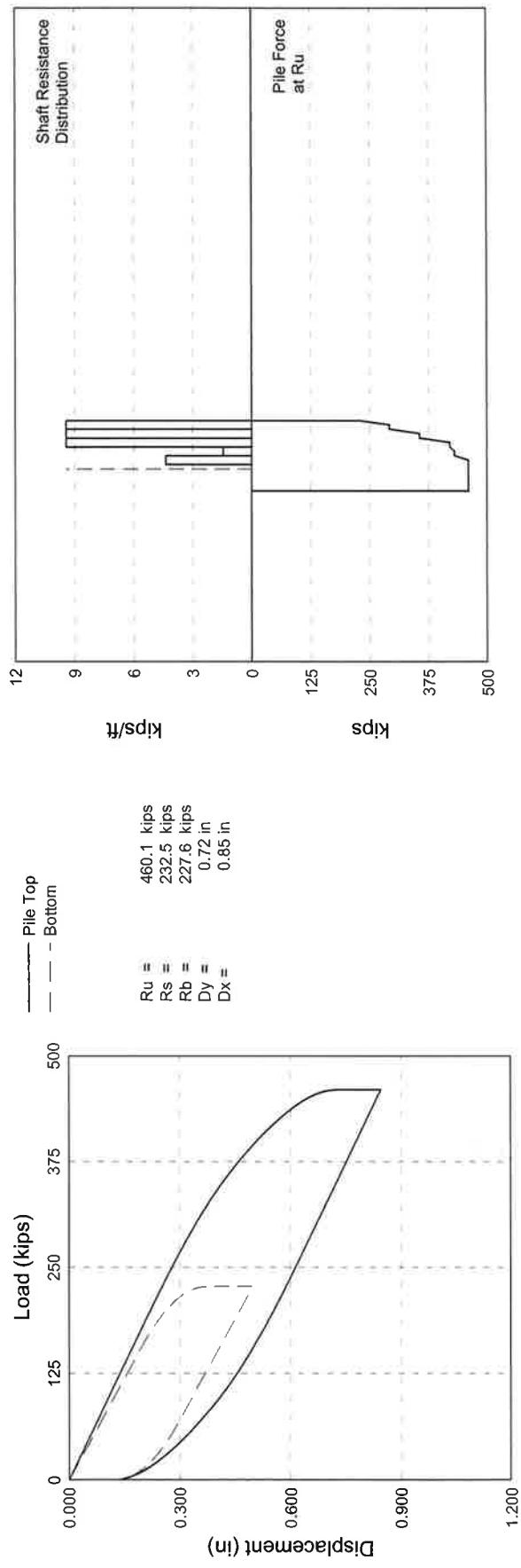
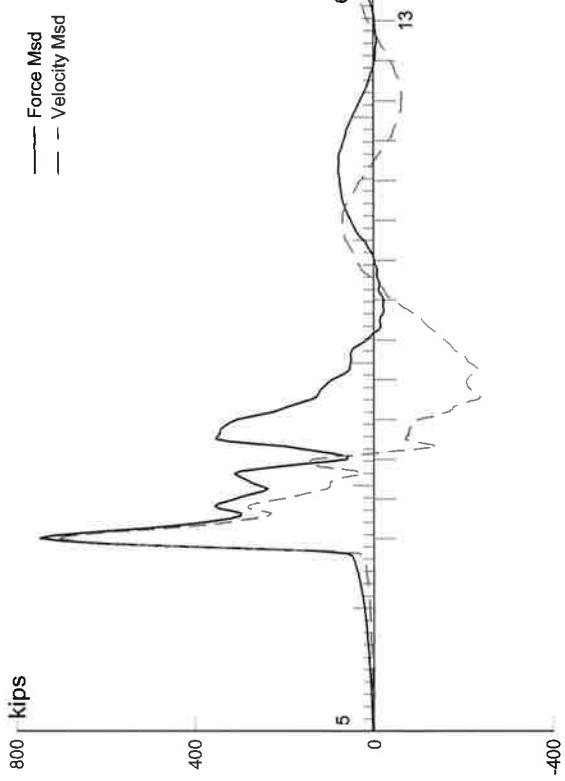
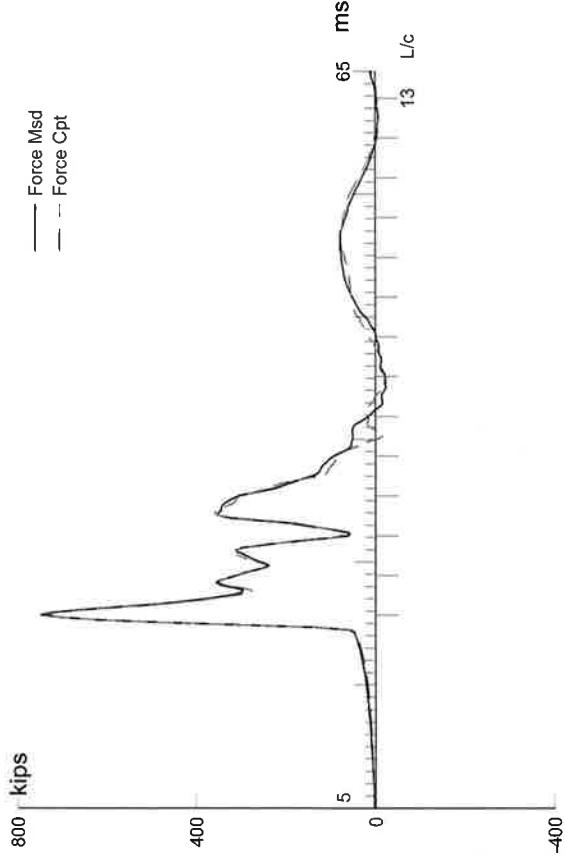
Total number of blows analyzed: 12

Time Summary

Drive 3 minutes 44 seconds 1:08:20 PM - 1:12:04 PM (9/5/2014) BN 1 - 14

GUILFORD BRO 1442(36); Pile: ABUTMENT 2 PILE 1 RS; APE D19-42 (HP14X89); Blow: 4 (Test: 05-Sep-2014 13:11.)
 GZA GeoEnvironmental Inc.

08-Sep-2014
 CAPWAP(R) 2006-3



GUILFORD BRO 1442(36) ; Pile: ABUTMENT 2 PILE 1 RS
APE D19-42 (HP14X89) ; Blow: 4
GZA GeoEnvironmental Inc.

Test: 05-Sep-2014 13:11:
CAPWAP(R) 2006-3
OP: JAH

CAPWAP SUMMARY RESULTS

| Total CAPWAP Capacity: 460.1; along Shaft | | | | 232.5; at Toe | 227.6 kips | | | |
|---|----------------------|----------------------|--------------------------------|--------------------|----------------|------------------------------|-------------------------|---------------------------|
| Soil Sgmnt No. | Dist. Below Gages ft | Depth Below Grade ft | Ru in Pile kips | Force in Pile kips | Sum of Ru kips | Unit Resist. (Depth) kips/ft | Unit Resist. (Area) ksf | Smith Damping Factor s/ft |
| | | | | 460.1 | | | | |
| 1 | 27.3 | 7.3 | 29.7 | 430.4 | 29.7 | 4.05 | 0.85 | 0.117 |
| 2 | 34.1 | 14.1 | 9.9 | 420.5 | 39.6 | 1.45 | 0.31 | 0.117 |
| 3 | 40.9 | 21.0 | 64.3 | 356.2 | 103.9 | 9.44 | 1.99 | 0.117 |
| 4 | 47.7 | 27.8 | 64.3 | 291.9 | 168.2 | 9.44 | 1.99 | 0.117 |
| 5 | 54.5 | 34.6 | 64.3 | 227.6 | 232.5 | 9.44 | 1.99 | 0.117 |
| Avg. Shaft | | | 46.5 | | 6.72 | | 1.41 | 0.117 |
| Toe | | | 227.6 | | 161.27 | | | 0.030 |
| Soil Model Parameters/Extensions | | | | | | | | |
| Quake | (in) | | | | 0.163 | 0.286 | | |
| Case Damping Factor | | | | | 0.585 | 0.149 | | |
| Unloading Quake | (% of loading quake) | | | | 46 | 43 | | |
| Reloading Level | (% of Ru) | | | | 100 | 100 | | |
| Unloading Level | (% of Ru) | | | | 14 | | | |
| Resistance Gap (included in Toe Quake) (in) | | | | | 0.003 | | | |
| Soil Plug Weight | (kips) | | | | 0.03 | | | |
| CAPWAP match quality | = | 2.20 | (Wave Up Match) ; RSA = 0 | | | | | |
| Observed: final set | = | 0.125 in; | blow count | = | 96 b/ft | | | |
| Computed: final set | = | 0.122 in; | blow count | = | 99 b/ft | | | |
| max. Top Comp. Stress | = | 28.4 ksi | (T= 21.1 ms, max= 1.052 x Top) | | | | | |
| max. Comp. Stress | = | 29.9 ksi | (Z= 27.3 ft, T= 22.5 ms) | | | | | |
| max. Tens. Stress | = | -2.58 ksi | (Z= 27.3 ft, T= 39.9 ms) | | | | | |
| max. Energy (EMX) | = | 20.6 kip-ft; | max. Measured Top Displ. (DMX) | = | 0.57 in | | | |

GUILFORD BRO 1442(36); Pile: ABUTMENT 2 PILE 1 RS
APE D19-42 (HP14X89); Blow: 4
GZA GeoEnvironmental Inc.

Test: 05-Sep-2014 13:11:
CAPWAP(R) 2006-3
OP: JAH

| EXTREMA TABLE | | | | | | | | | |
|----------------|----------------------|-----------------|-----------------|-----------------------|-----------------------|----------------------------|------------------|----------------|--|
| Pile Sgmnt No. | Dist. Below Gages ft | max. Force kips | min. Force kips | max. Comp. Stress ksi | max. Tens. Stress ksi | max. Trnsfd. Energy kip-ft | max. Veloc. ft/s | max. Displ. in | |
| 1 | 3.4 | 742.5 | -33.5 | 28.4 | -1.28 | 20.55 | 15.5 | 0.573 | |
| 2 | 6.8 | 742.8 | -39.8 | 28.5 | -1.52 | 20.47 | 15.4 | 0.563 | |
| 3 | 10.2 | 743.3 | -44.4 | 28.5 | -1.70 | 20.34 | 15.4 | 0.550 | |
| 4 | 13.6 | 743.8 | -50.0 | 28.5 | -1.91 | 20.12 | 15.4 | 0.534 | |
| 5 | 17.0 | 744.7 | -55.6 | 28.5 | -2.13 | 19.87 | 15.3 | 0.516 | |
| 6 | 20.4 | 753.4 | -59.0 | 28.9 | -2.26 | 19.62 | 15.1 | 0.499 | |
| 7 | 23.8 | 768.1 | -62.2 | 29.4 | -2.38 | 19.33 | 14.8 | 0.480 | |
| 8 | 27.3 | 780.7 | -67.5 | 29.9 | -2.58 | 19.01 | 14.5 | 0.460 | |
| 9 | 30.7 | 715.8 | -64.5 | 27.4 | -2.47 | 16.81 | 14.4 | 0.443 | |
| 10 | 34.1 | 734.7 | -66.5 | 28.1 | -2.55 | 16.55 | 13.9 | 0.425 | |
| 11 | 37.5 | 739.9 | -64.7 | 28.3 | -2.48 | 15.65 | 13.3 | 0.406 | |
| 12 | 40.9 | 770.7 | -67.2 | 29.5 | -2.57 | 15.29 | 12.6 | 0.385 | |
| 13 | 44.3 | 661.1 | -50.0 | 25.3 | -1.91 | 11.69 | 12.2 | 0.367 | |
| 14 | 47.7 | 615.9 | -48.8 | 23.6 | -1.87 | 11.50 | 13.9 | 0.351 | |
| 15 | 51.1 | 389.0 | -30.4 | 14.9 | -1.16 | 8.11 | 15.7 | 0.338 | |
| 16 | 54.5 | 378.3 | -29.4 | 14.5 | -1.12 | 5.25 | 15.6 | 0.324 | |
| Absolute | 27.3 | | | 29.9 | | | (T = 22.5 ms) | | |
| | 27.3 | | | | -2.58 | | (T = 39.9 ms) | | |

| CASE METHOD | | | | | | | | | | |
|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| J = | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| RP | 703.8 | 625.6 | 547.4 | 469.2 | 391.0 | 312.8 | 234.6 | 156.4 | 78.2 | 0.0 |
| RX | 703.8 | 627.8 | 569.0 | 528.5 | 501.7 | 478.4 | 466.0 | 455.2 | 444.3 | 433.5 |
| RU | 703.8 | 625.6 | 547.4 | 469.2 | 391.0 | 312.8 | 234.6 | 156.4 | 78.2 | 0.0 |

RAU = 388.5 (kips); RA2 = 483.9 (kips)

Current CAPWAP Ru = 460.1 (kips); Corresponding J(RP) = 0.31; J(RX) = 0.65

| VMX ft/s | TVP ms | VT1*Z kips | FT1 kips | FMX kips | DMX in | DFN in | SET in | EMX kip-ft | QUS kips |
|----------|--------|------------|----------|----------|--------|--------|--------|------------|----------|
| 15.59 | 20.87 | 726.1 | 759.8 | 759.8 | 0.565 | 0.125 | 0.125 | 20.7 | 720.1 |

PILE PROFILE AND PILE MODEL

| Depth ft | Area in ² | E-Modulus ksi | Spec. Weight lb/ft ³ | Perim. ft |
|----------|----------------------|---------------|---------------------------------|-----------|
| 0.00 | 26.10 | 29992.2 | 492.000 | 4.754 |
| 54.50 | 26.10 | 29992.2 | 492.000 | 4.754 |

Toe Area 1.411 ft²

Top Segment Length 3.41 ft, Top Impedance 46.59 kips/ft/s

Pile Damping 1.0 %, Time Incr 0.203 ms, Wave Speed 16807.9 ft/s, 2L/c 6.5 ms

SAXIMETER BLOW COUNT/STROKE PILE DRIVING RECORD

Pile # / Time: Start/stop 2:55 Date: 9/3/14
 Project Gulford BRO 1442(36) Location None
 Pile Type/size HP 14x89 Length _____ Batter _____
 Elevation: Ground Pile Tip _____
 Hammer Type/Size APE D19-42 Throttle Setting: 2
 Cap/Helmet/Cushion Monocast MC-904(P)
 Contractor Renaud Bros, Inc. Pile Length _____ Cutoff: _____ Pay length _____

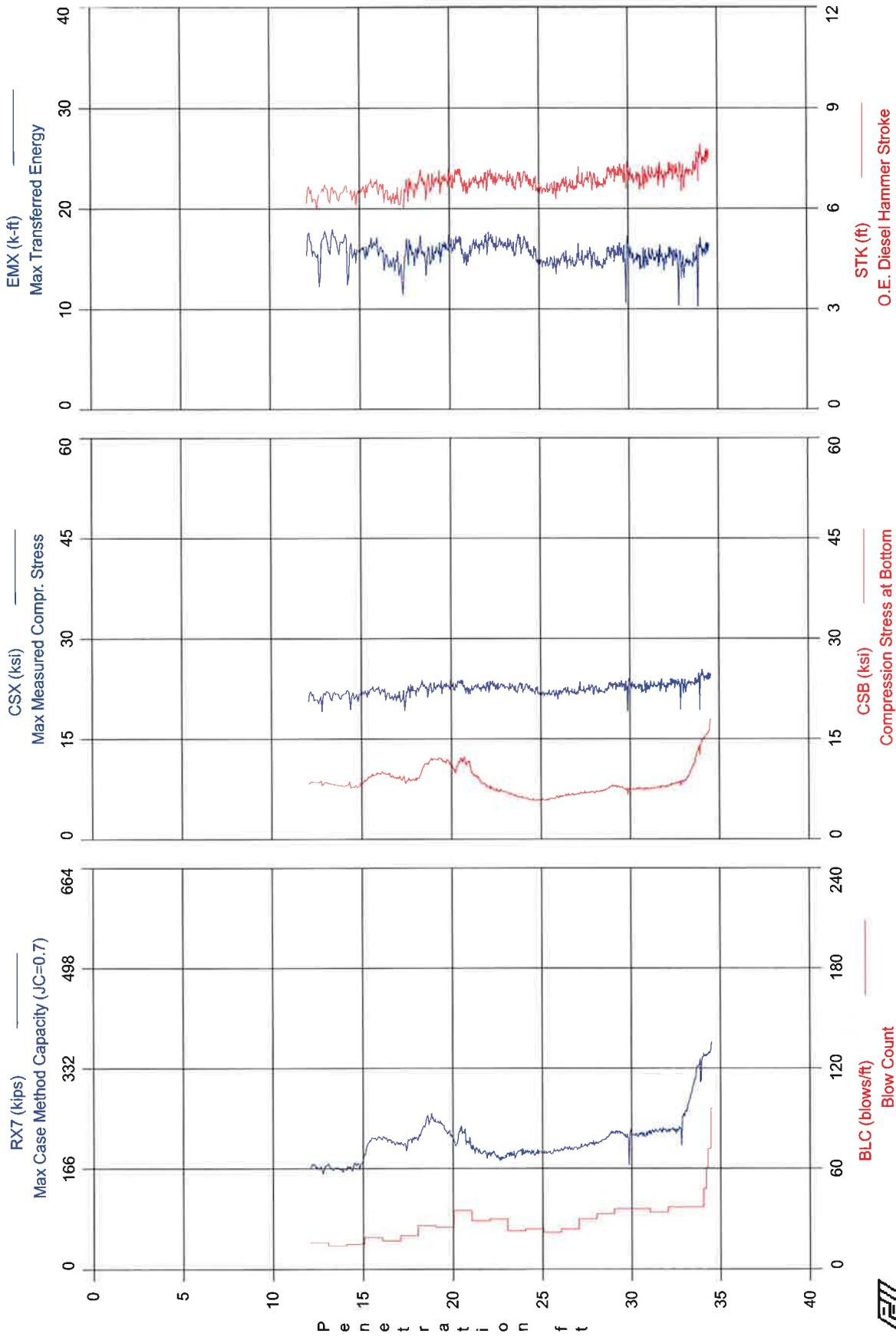
| Depth ft | Blow/ft ft | H BPM |
|-------------|---------------|----------|-------------|---------------|----------|-------------|---------------|----------|-------------|---------------|----------|
| 0-1 | | | 25-26 | 2.1 | 6.1 | 50-51 | | | | | |
| 1-2 | | | 26-27 | 2.3 | 6.6 | 51-52 | | | | | |
| 2-3 | | | 27-28 | 2.9 | 6.3 | 52-53 | | | | | |
| 3-4 | | | 28-29 | 3.1 | 6.6 | 53-54 | | | | | |
| 4-5 | | | 29-30 | 3.0 | 6.7 | 54-55 | | | | | |
| 5-6 | | | 30-31 | 3.5 | 6.8 | 55-56 | | | | | |
| 6-7 | | | 31-32 | 3.5 | 6.8 | 56-57 | | | | | |
| 7-8 | | | 32-33 | 3.3 | 6.7 | 57-58 | | | | | |
| 8-9 | | | 33-34 | 3.6 | 6.7 | 58-59 | | | | | |
| 9-10 | | | 34-35 | 4.2 | 6.9 | 59-60 | | | | | |
| 10-11 | | | 35-36 | | | 60-61 | | | | | |
| 11-12 | | | 36-37 | | | 61-62 | | | | | |
| 12-13 | | | 37-38 | | | 62-63 | | | | | |
| 13-14 | | | 38-39 | | | 63-64 | | | | | |
| 14-15 | | | 39-40 | | | 64-65 | | | | | |
| 15-16 | | | 40-41 | | | 65-66 | | | | | |
| 16-17 | | | 41-42 | | | 66-67 | | | | | |
| 17-18 | 34 | 6.5 | 42-43 | | | 67-68 | | | | | |
| 18-19 | 24 | 6.5 | 43-44 | | | 68-69 | | | | | |
| 19-20 | 35 | 6.4 | 44-45 | | | 69-70 | | | | | |
| 20-21 | 30 | 6.3 | 45-46 | | | 70-71 | | | | | |
| 21-22 | 25 | 6.1 | 46-47 | | | 71-72 | | | | | |
| 22-23 | 27 | 6.3 | 47-48 | | | 72-73 | | | | | |
| 23-24 | 35 | 6.5 | 48-49 | | | 73-74 | | | | | |
| 24-25 | 26 | 6.3 | 49-50 | | | 74-75 | | | | | |

| Remarks | Depth | Min | Interruption Reason |
|---------|-------|-----|---------------------|
| | | | |
| | | | |
| | | | |
| | | | |

blow/inch

| | | | | | | | |
|---|-----|----|-----|----|-----|--|--|
| 4 | 6.4 | 9. | 7.3 | 9 | 7.2 | | |
| 5 | 6.4 | 12 | 7.2 | 10 | 7.3 | | |
| 7 | 7.1 | 9. | 7.4 | | | | |

GUILFORD BRO 1442(36) - ABUTMENT 2 PILE 2 ID -APE D19-42 (HP14X89)



GUILFORD BRO 1442(36) - ABUTMENT 2 PILE 2 ID
OP: CAG

APE D19-42 (HP14X89)
Test date: 4-Sep-2014

| | | | |
|-----|-----------------------|-----|-------------------------|
| AR: | 26.10 in ² | SP: | 0.492 k/ft ³ |
| LE: | 45.25 ft | EM: | 30,000 ksi |
| WS: | 16,807.9 f/s | JC: | 0.35 |

| | | | |
|------|-----------------------------------|------|--------------------------------|
| RX7: | Max Case Method Capacity (JC=0.7) | EMX: | Max Transferred Energy |
| CSX: | Max Measured Compr. Stress | STK: | O.E. Diesel Hammer Stroke |
| CSB: | Compression Stress at Bottom | FVP: | Force/Velocity proportionality |

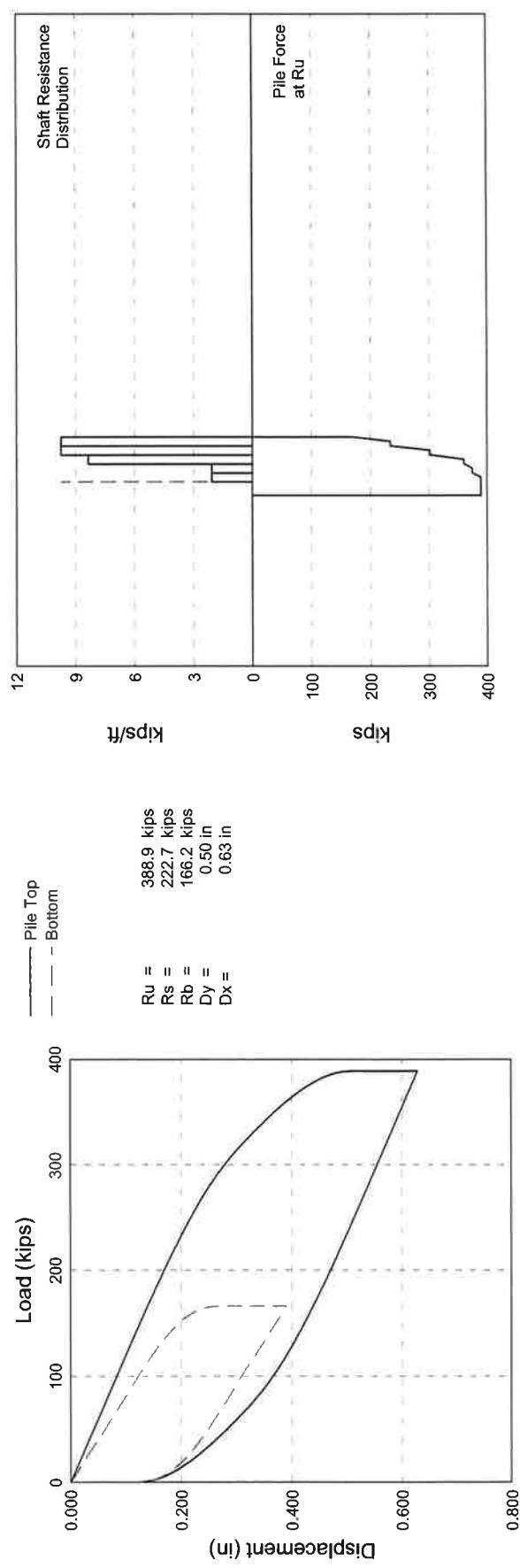
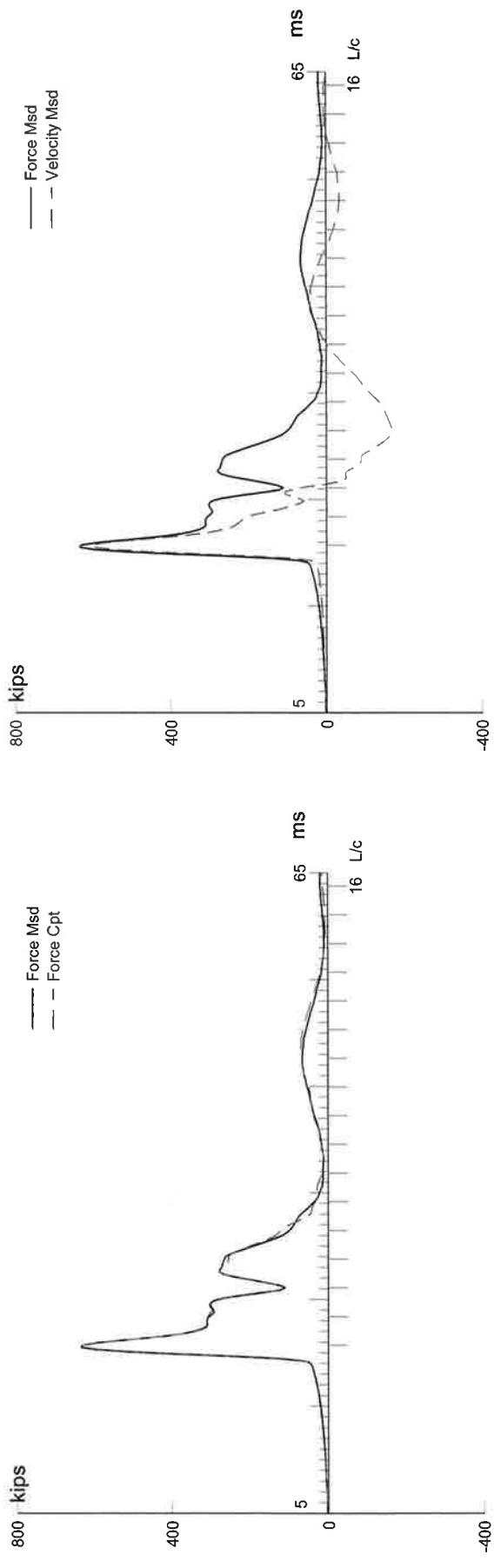
| BL# end | depth ft | BLC bl/ft | TYPE | RX7 kips | CSX ksi | CSB ksi | EMX k-ft | STK ft | FVP [] |
|------------|-------------|--------------|------|-------------|------------|------------|-------------|-----------|------------|
| 17 | 13.00 | 16 | AV16 | 168 | 21.2 | 8.5 | 15.8 | 6.37 | 1.01 |
| 31 | 14.00 | 14 | AV14 | 166 | 21.6 | 8.2 | 16.7 | 6.45 | 1.00 |
| 46 | 15.00 | 15 | AV15 | 171 | 21.5 | 8.0 | 15.6 | 6.46 | 1.00 |
| 65 | 16.00 | 19 | AV19 | 211 | 22.2 | 9.4 | 16.1 | 6.65 | 1.00 |
| 82 | 17.00 | 17 | AV17 | 212 | 21.6 | 9.7 | 15.0 | 6.43 | 1.00 |
| 102 | 18.00 | 20 | AV20 | 211 | 21.7 | 9.0 | 14.9 | 6.48 | 1.00 |
| 128 | 19.00 | 26 | AV26 | 239 | 22.6 | 10.9 | 15.4 | 6.73 | 1.00 |
| 153 | 20.00 | 25 | AV25 | 233 | 22.9 | 11.8 | 15.9 | 6.85 | 1.00 |
| 188 | 21.00 | 35 | AV35 | 218 | 22.9 | 11.3 | 16.0 | 6.86 | 1.00 |
| 217 | 22.00 | 29 | AV29 | 196 | 22.7 | 9.0 | 16.2 | 6.79 | 1.00 |
| 247 | 23.00 | 30 | AV30 | 188 | 23.0 | 7.4 | 16.6 | 6.91 | 1.00 |
| 270 | 24.00 | 23 | AV23 | 192 | 22.7 | 6.6 | 16.4 | 6.86 | 1.00 |
| 294 | 25.00 | 24 | AV24 | 194 | 22.4 | 6.0 | 15.8 | 6.80 | 1.00 |
| 316 | 26.00 | 22 | AV22 | 194 | 21.8 | 6.2 | 14.6 | 6.59 | 1.01 |
| 340 | 27.00 | 24 | AV24 | 200 | 22.1 | 6.7 | 14.8 | 6.70 | 1.01 |
| 370 | 28.00 | 30 | AV30 | 206 | 22.4 | 7.1 | 15.1 | 6.84 | 1.01 |
| 403 | 29.00 | 33 | AV33 | 217 | 22.5 | 7.6 | 14.9 | 6.86 | 1.01 |
| 439 | 30.00 | 36 | AV36 | 222 | 22.9 | 7.7 | 15.5 | 7.07 | 1.01 |
| 475 | 31.00 | 36 | AV36 | 222 | 22.7 | 7.5 | 15.0 | 6.91 | 1.01 |
| 509 | 32.00 | 34 | AV34 | 228 | 22.9 | 7.7 | 15.1 | 7.01 | 1.01 |
| 546 | 33.00 | 37 | AV37 | 234 | 23.1 | 8.3 | 15.0 | 7.10 | 1.00 |
| 583 | 34.00 | 37 | AV37 | 307 | 23.3 | 11.2 | 14.6 | 7.16 | 1.01 |
| 587 | 34.08 | 48 | AV4 | 354 | 24.9 | 14.9 | 16.6 | 7.77 | 1.00 |
| 591 | 34.17 | 48 | AV4 | 354 | 24.1 | 15.1 | 15.8 | 7.47 | 1.00 |
| 596 | 34.25 | 60 | AV5 | 355 | 24.2 | 15.5 | 15.8 | 7.49 | 1.00 |
| 602 | 34.33 | 72 | AV6 | 358 | 24.2 | 15.7 | 15.8 | 7.49 | 1.00 |
| 608 | 34.42 | 72 | AV6 | 360 | 24.5 | 16.0 | 16.3 | 7.64 | 1.00 |
| 616 | 34.50 | 96 | AV8 | 371 | 24.4 | 17.3 | 16.2 | 7.63 | 1.00 |

Time Summary

Drive 25 minutes 26 seconds 3:54:34 PM - 4:20:00 PM (9/4/2014) BN 1 - 617

GUILFORD BRO 1442(36); Pile: ABUTMENT 2 PILE 2 ID; APE D19-42 (HP14X89); Blow: 614 (Test: 04-Sep-2014 16:19:)
GZA GeoEnvironmental Inc.

08-Sep-2014
CAPWAP(R) 2006-3



GUILFORD BRO 1442(36); Pile: ABUTMENT 2 FILE 2 ID
APE D19-42 (HP14X89); Blow: 614
GZA GeoEnvironmental Inc.

Test: 04-Sep-2014 16:19:
CAPWAP(R) 2006-3
OP: CAG

CAPWAP SUMMARY RESULTS

| Total CAPWAP Capacity: 388.9; along Shaft 222.7; at Toe 166.2 kips | | | | | | | | |
|--|----------------------|----------------------|--------------------------------|--------------------|----------------|------------------------------|-------------------------|---------------------------|
| Soil Sgmnt No. | Dist. Below Gages ft | Depth Below Grade ft | Ru in Pile kips | Force in Pile kips | Sum of Ru kips | Unit Resist. (Depth) kips/ft | Unit Resist. (Area) ksf | Smith Damping Factor s/ft |
| | | | | 388.9 | | | | |
| 1 | 17.4 | 6.7 | 14.5 | 374.4 | 14.5 | 2.18 | 0.47 | 0.098 |
| 2 | 24.4 | 13.6 | 14.5 | 359.9 | 29.0 | 2.08 | 0.45 | 0.098 |
| 3 | 31.3 | 20.6 | 58.1 | 301.8 | 87.1 | 8.35 | 1.79 | 0.098 |
| 4 | 38.3 | 27.5 | 67.8 | 234.0 | 154.9 | 9.74 | 2.09 | 0.098 |
| 5 | 45.3 | 34.5 | 67.8 | 166.2 | 222.7 | 9.74 | 2.09 | 0.098 |
| Avg. Shaft | | | 44.5 | | | 6.46 | 1.38 | 0.098 |
| Toe | | | 166.2 | | | | 122.11 | 0.070 |
| <u>Soil Model Parameters/Extensions</u> | | | | | | | | |
| Quake | (in) | | | | 0.098 | 0.203 | | |
| Case Damping Factor | | | | | 0.468 | 0.250 | | |
| Unloading Quake | (% of loading quake) | | | | 77 | 59 | | |
| Reloading Level | (% of Ru) | | | | 100 | 100 | | |
| Unloading Level | (% of Ru) | | | | 4 | | | |
| Soil Plug Weight | (kips) | | | | | 0.05 | | |
| CAPWAP match quality | = | 1.48 | (Wave Up Match) ; RSA = 0 | | | | | |
| Observed: final set | = | 0.125 in; | blow count | = | 96 b/ft | | | |
| Computed: final set | = | 0.140 in; | blow count | = | 86 b/ft | | | |
| max. Top Comp. Stress | = | 24.3 ksi | (T= 21.1 ms, max= 1.069 x Top) | | | | | |
| max. Comp. Stress | = | 26.0 ksi | (Z= 31.3 ft, T= 22.8 ms) | | | | | |
| max. Tens. Stress | = | -1.01 ksi | (Z= 31.3 ft, T= 38.5 ms) | | | | | |
| max. Energy (EMX) | = | 15.9 kip-ft; | max. Measured Top Displ. (DMX) | = | 0.48 in | | | |

GUILFORD BRO 1442(36); Pile: ABUTMENT 2 PILE 2 ID
APE D19-42 (HP14X89); Blow: 614
GZA GeoEnvironmental Inc.

Test: 04-Sep-2014 16:19:
CAPWAP(R) 2006-3
OP: CAG

| EXTREMA TABLE | | | | | | | | | |
|---------------|-------------------|------------|------------|-------------------|-------------------|---------------------|---------------|-------------|--|
| Pile Sgmnt | Dist. Below Gages | max. Force | min. Force | max. Comp. Stress | max. Tens. Stress | max. Trnsfd. Energy | max. Veloc. | max. Displ. | |
| No. | ft | kips | kips | ksi | ksi | kip-ft | ft/s | in | |
| 1 | 3.5 | 635.5 | -11.6 | 24.3 | -0.44 | 15.93 | 12.9 | 0.474 | |
| 2 | 7.0 | 637.7 | -11.8 | 24.4 | -0.45 | 15.84 | 12.9 | 0.464 | |
| 3 | 10.4 | 643.4 | -12.2 | 24.6 | -0.47 | 15.71 | 12.8 | 0.451 | |
| 4 | 13.9 | 651.3 | -12.4 | 24.9 | -0.47 | 15.54 | 12.6 | 0.436 | |
| 5 | 17.4 | 659.4 | -15.1 | 25.3 | -0.58 | 15.32 | 12.4 | 0.420 | |
| 6 | 20.9 | 637.9 | -16.8 | 24.4 | -0.64 | 14.31 | 12.2 | 0.403 | |
| 7 | 24.4 | 657.4 | -20.5 | 25.2 | -0.79 | 14.06 | 11.9 | 0.385 | |
| 8 | 27.8 | 651.0 | -22.5 | 24.9 | -0.86 | 13.13 | 11.4 | 0.368 | |
| 9 | 31.3 | 679.5 | -26.3 | 26.0 | -1.01 | 12.91 | 10.8 | 0.351 | |
| 10 | 34.8 | 572.2 | -22.5 | 21.9 | -0.86 | 10.30 | 10.5 | 0.337 | |
| 11 | 38.3 | 552.8 | -25.9 | 21.2 | -0.99 | 10.13 | 11.5 | 0.322 | |
| 12 | 41.8 | 369.9 | -18.5 | 14.2 | -0.71 | 7.34 | 12.4 | 0.311 | |
| 13 | 45.3 | 375.2 | -19.9 | 14.4 | -0.76 | 4.95 | 12.3 | 0.298 | |
| Absolute | | 31.3 | | 26.0 | | | (T = 22.8 ms) | | |
| | | 31.3 | | | -1.01 | | (T = 38.5 ms) | | |

| CASE METHOD | | | | | | | | | | |
|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| J = | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| RP | 646.5 | 585.1 | 523.7 | 462.3 | 401.0 | 339.6 | 278.2 | 216.8 | 155.4 | 94.0 |
| RX | 647.6 | 587.9 | 531.4 | 481.5 | 437.4 | 405.0 | 392.1 | 383.3 | 374.4 | 366.4 |
| RU | 646.5 | 585.1 | 523.7 | 462.3 | 401.0 | 339.6 | 278.2 | 216.8 | 155.4 | 94.0 |

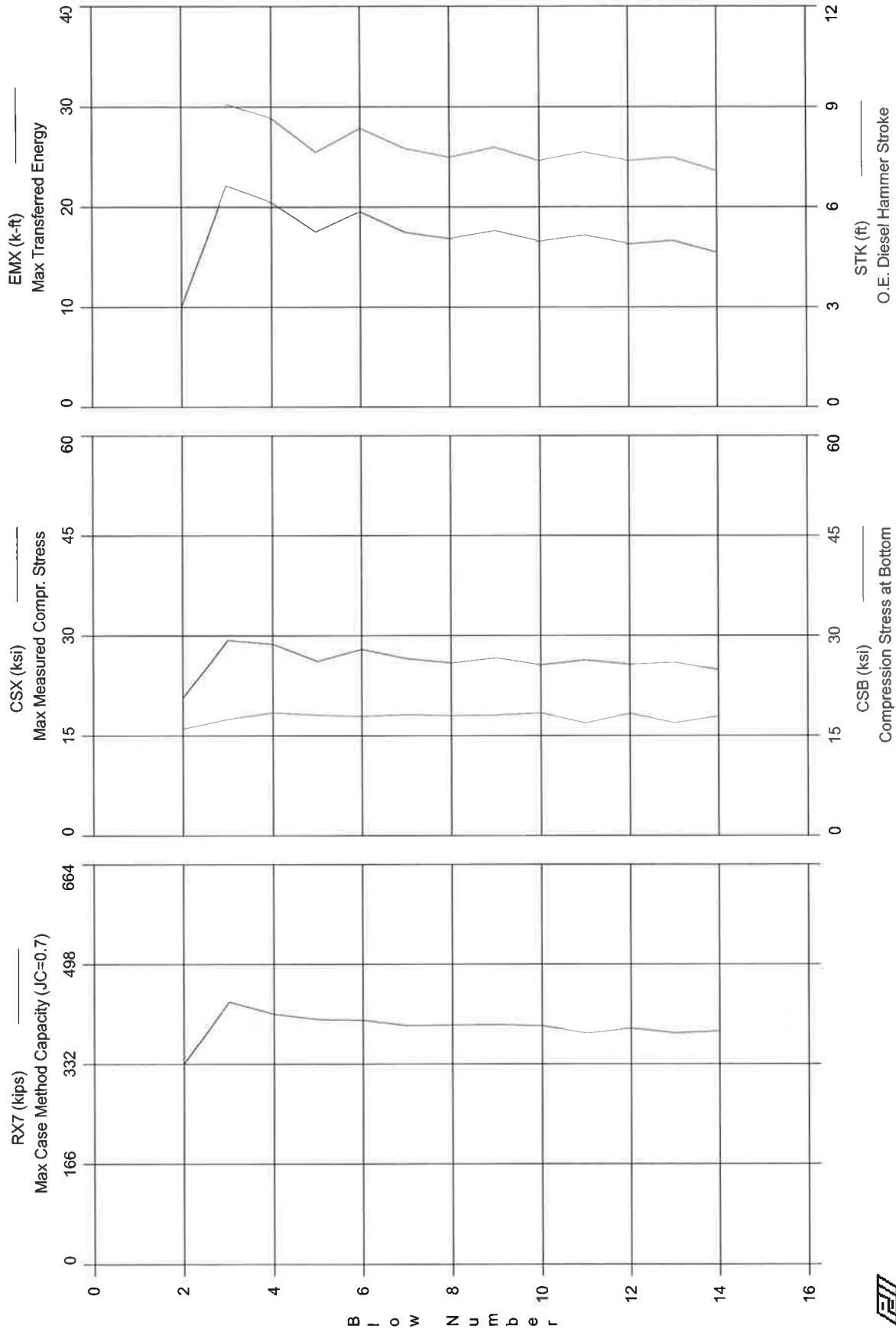
RAU = 278.5 (kips); RA2 = 445.3 (kips)

Current CAPWAP Ru = 388.9 (kips); Corresponding J(RP)= 0.42; J(RX) = 0.64

| VMX ft/s | TVP ms | VT1*Z kips | FT1 kips | FMX kips | DMX in | DFN in | SET in | EMX kip-ft | QUS kips |
|----------|--------|------------|----------|----------|--------|--------|--------|------------|----------|
| 13.20 | 20.92 | 615.0 | 645.4 | 645.4 | 0.483 | 0.125 | 0.125 | 16.1 | 634.8 |

| PILE PROFILE AND PILE MODEL | | | | | | | | | |
|-----------------------------|--|------------------------|--|----------------------|--|---------------------------------|--|-----------|--|
| Depth ft | | Area in ² | | E-Modulus ksi | | Spec. Weight lb/ft ³ | | Perim. ft | |
| 0.00 | | 26.10 | | 29992.2 | | 492.000 | | 4.667 | |
| 45.25 | | 26.10 | | 29992.2 | | 492.000 | | 4.667 | |
| Toe Area | | 1.361 ft ² | | | | | | | |
| Top Segment Length | | 3.48 ft, Top Impedance | | 46.59 kips/ft/s | | | | | |
| Pile Damping | | 1.0 %, Time Incr | | 0.207 ms, Wave Speed | | 16807.9 ft/s, 2L/c | | 5.4 ms | |

GUILFORD BRO 1442(36) - ABUTMENT 2 PILE 2 RS - APE D19-42 (HP14x89)



GUILFORD BRO 1442(36) - ABUTMENT 2 PILE 2 RS
OP: JAH

APE D19-42 (HP14X89)
Test date: 5-Sep-2014

AR: 26.10 in²
LE: 45.25 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.50

| | |
|--|-------------------------------------|
| RX7: Max Case Method Capacity (JC=0.7) | EMX: Max Transferred Energy |
| CSX: Max Measured Compr. Stress | STK: O.E. Diesel Hammer Stroke |
| CSB: Compression Stress at Bottom | FVP: Force/Velocity proportionality |

| BL# | RX7 kips | CSX ksi | CSB ksi | EMX k-ft | STK ft | FVP [] |
|---------|-------------|------------|------------|-------------|-----------|------------|
| 2 | 332 | 20.7 | 16.0 | 10.1 | 0.00 | 0.99 |
| 3 | 435 | 29.3 | 17.5 | 22.1 | 9.07 | 0.97 |
| 4 | 415 | 28.7 | 18.4 | 20.5 | 8.66 | 0.98 |
| 5 | 406 | 26.1 | 18.1 | 17.5 | 7.64 | 0.98 |
| 6 | 405 | 27.9 | 17.9 | 19.5 | 8.36 | 0.97 |
| 7 | 396 | 26.6 | 18.1 | 17.5 | 7.75 | 0.98 |
| 8 | 397 | 25.9 | 18.0 | 16.8 | 7.49 | 0.98 |
| 9 | 397 | 26.6 | 18.1 | 17.6 | 7.79 | 0.97 |
| 10 | 395 | 25.6 | 18.4 | 16.5 | 7.39 | 0.98 |
| 11 | 383 | 26.3 | 16.9 | 17.1 | 7.64 | 0.98 |
| 12 | 392 | 25.7 | 18.3 | 16.3 | 7.39 | 0.97 |
| 13 | 383 | 26.0 | 16.9 | 16.6 | 7.49 | 0.97 |
| 14 | 386 | 24.8 | 17.9 | 15.4 | 7.08 | 0.97 |
| Average | 394 | 26.2 | 17.7 | 17.2 | 7.81 | 0.98 |

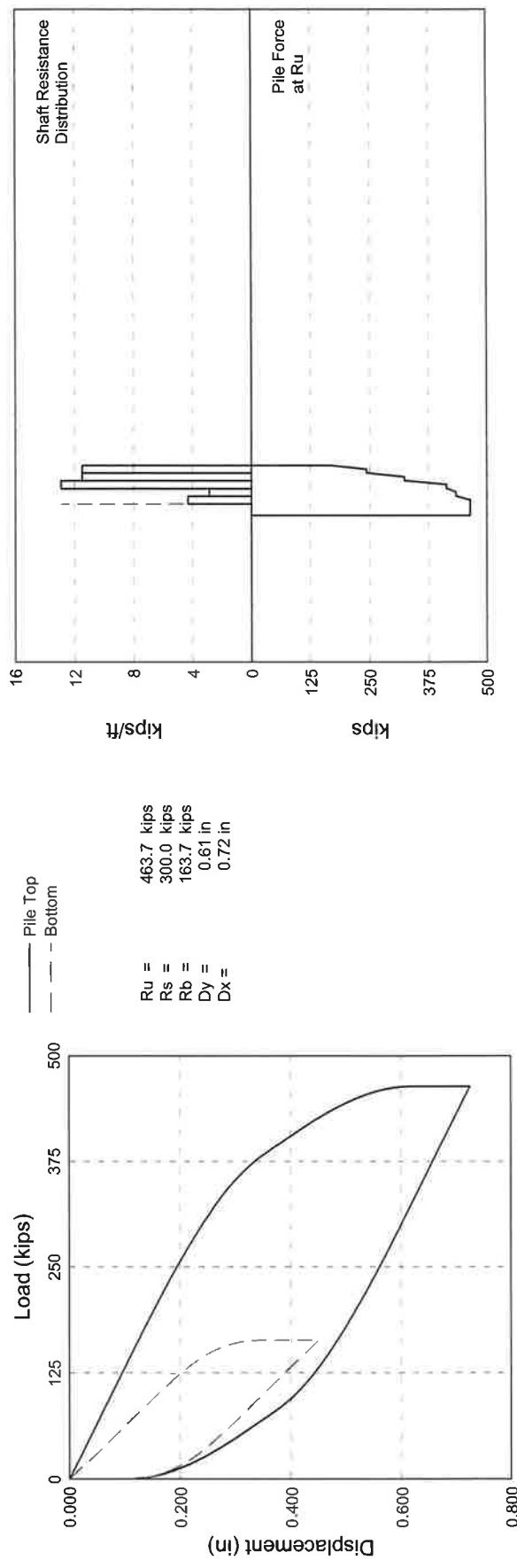
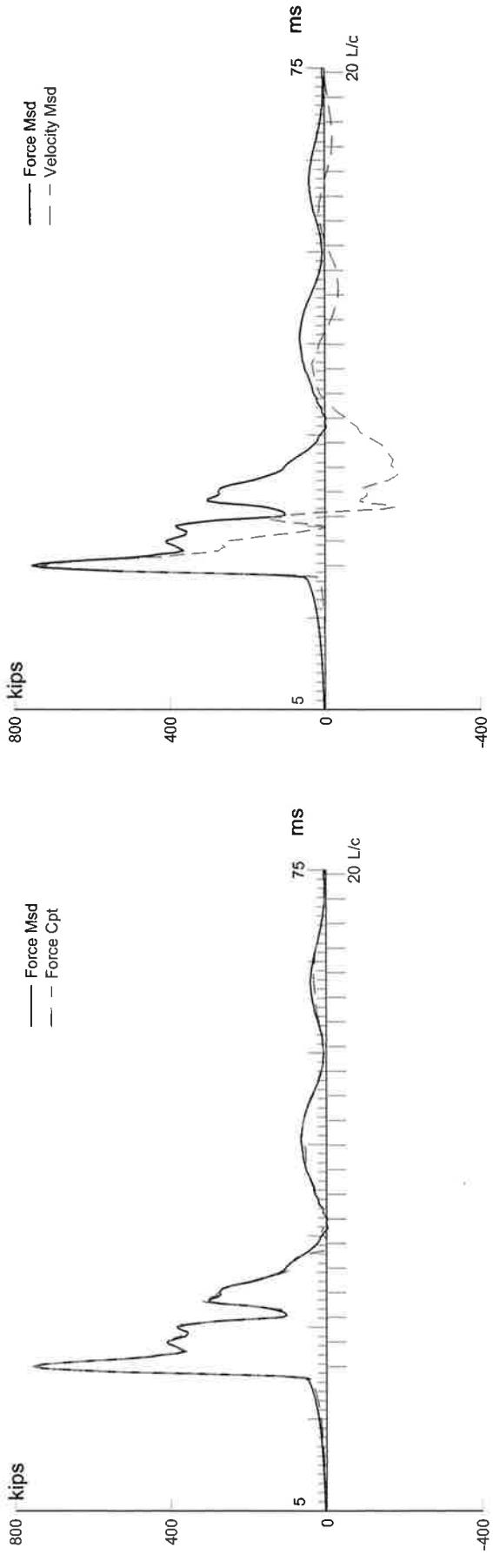
Total number of blows analyzed: 13

Time Summary

Drive 1 minute 24 seconds 1:39:03 PM - 1:40:27 PM (9/5/2014) BN 1 - 15

GUILFORD BRO 1442(36); Pile: ABUTMENT 2 PILE 2 RS; APE D19-42 (HP14X89); Blow: 3 (Test: 05-Sep-2014 13:40:)
GZA GeoEnvironmental Inc.

08-Sep-2014
 CAPWAP(R) 2006-3



GUILFORD BRO 1442(36); Pile: ABUTMENT 2 PILE 2 RS
APE D19-42 (HP14X89); Blow: 3
GZA GeoEnvironmental Inc.

Test: 05-Sep-2014 13:40:
CAPWAP(R) 2006-3
OP: JAH

CAPWAP SUMMARY RESULTS

| Total CAPWAP Capacity: 463.7; along Shaft | | | | 300.0; at Toe | 163.7 | kips | | |
|---|----------------------|----------------------|--------------------------|--------------------|----------------|------------------------------|-------------------------|---------------------------|
| Soil Sgmnt No. | Dist. Below Gages ft | Depth Below Grade ft | Ru in Pile kips | Force in Pile kips | Sum of Ru kips | Unit Resist. (Depth) kips/ft | Unit Resist. (Area) ksf | Smith Damping Factor s/ft |
| | | | | 463.7 | | | | |
| 1 | 17.4 | 6.7 | 30.0 | 433.7 | 30.0 | 4.51 | 0.95 | 0.120 |
| 2 | 24.4 | 13.6 | 20.0 | 413.7 | 50.0 | 2.87 | 0.60 | 0.120 |
| 3 | 31.3 | 20.6 | 90.0 | 323.7 | 140.0 | 12.93 | 2.72 | 0.120 |
| 4 | 38.3 | 27.5 | 80.0 | 243.7 | 220.0 | 11.49 | 2.42 | 0.120 |
| 5 | 45.3 | 34.5 | 80.0 | 163.7 | 300.0 | 11.49 | 2.42 | 0.120 |
| Avg. Shaft | | | 60.0 | | 8.70 | | 1.83 | 0.120 |
| Toe | | | 163.7 | | | | 115.99 | 0.075 |
| Soil Model Parameters/Extensions | | | | | Shaft | Toe | | |
| Quake | (in) | | | | 0.107 | 0.260 | | |
| Case Damping Factor | | | | | 0.775 | 0.265 | | |
| Damping Type | | | | | | Smith | | |
| Unloading Quake | (% of loading quake) | | | | 76 | 59 | | |
| Reloading Level | (% of Ru) | | | | 100 | 100 | | |
| Unloading Level | (% of Ru) | | | | 0 | | | |
| Resistance Gap (included in Toe Quake) (in) | | | | | | 0.054 | | |
| Soil Plug Weight | (kips) | | | | | 0.21 | | |
| CAPWAP match quality | = | 1.39 | (Wave Up Match) | ; RSA = 0 | | | | |
| Observed: final set | = | 0.111 in; | blow count | = | 108 b/ft | | | |
| Computed: final set | = | 0.150 in; | blow count | = | 80 b/ft | | | |
| max. Top Comp. Stress | = | 29.0 ksi | (T= 21.1 ms, | max= 1.062 x Top) | | | | |
| max. Comp. Stress | = | 30.8 ksi | (Z= 17.4 ft, | T= 22.0 ms) | | | | |
| max. Tens. Stress | = | -1.18 ksi | (Z= 31.3 ft, | T= 37.9 ms) | | | | |
| max. Energy (EMX) | = | 21.6 kip-ft; | max. Measured Top Displ. | (DMX)= 0.51 in | | | | |

GUILFORD BRO 1442(36); Pile: ABUTMENT 2 PILE 2 RS
APE D19-42 (HP14X89); Blow: 3
GZA GeoEnvironmental Inc.

Test: 05-Sep-2014 13:40:
CAPWAP(R) 2006-3
OP: JAH

| EXTREMA TABLE | | | | | | | | | |
|----------------|----------------------|-----------------|-----------------|-----------------------|-----------------------|----------------------------|------------------|----------------|--|
| Pile Sgmnt No. | Dist. Below Gages ft | max. Force kips | min. Force kips | max. Comp. Stress ksi | max. Tens. Stress ksi | max. Trnsfd. Energy kip-ft | max. Veloc. ft/s | max. Displ. in | |
| 1 | 3.5 | 757.6 | -6.3 | 29.0 | -0.24 | 21.60 | 15.7 | 0.519 | |
| 2 | 7.0 | 758.7 | -11.1 | 29.1 | -0.43 | 21.49 | 15.7 | 0.508 | |
| 3 | 10.4 | 769.3 | -18.6 | 29.5 | -0.71 | 21.29 | 15.4 | 0.492 | |
| 4 | 13.9 | 786.0 | -24.6 | 30.1 | -0.94 | 20.99 | 15.1 | 0.473 | |
| 5 | 17.4 | 804.6 | -26.9 | 30.8 | -1.03 | 20.62 | 14.7 | 0.451 | |
| 6 | 20.9 | 734.5 | -24.6 | 28.1 | -0.94 | 18.21 | 14.4 | 0.431 | |
| 7 | 24.4 | 767.2 | -27.1 | 29.4 | -1.04 | 17.91 | 13.7 | 0.411 | |
| 8 | 27.8 | 754.7 | -27.1 | 28.9 | -1.04 | 16.38 | 12.8 | 0.392 | |
| 9 | 31.3 | 801.0 | -30.8 | 30.7 | -1.18 | 16.05 | 11.8 | 0.372 | |
| 10 | 34.8 | 633.9 | -24.4 | 24.3 | -0.94 | 11.26 | 11.1 | 0.356 | |
| 11 | 38.3 | 636.2 | -27.0 | 24.4 | -1.03 | 11.09 | 12.8 | 0.341 | |
| 12 | 41.8 | 409.1 | -19.8 | 15.7 | -0.76 | 7.08 | 14.4 | 0.330 | |
| 13 | 45.3 | 307.4 | -19.7 | 11.8 | -0.75 | 3.16 | 15.0 | 0.318 | |
| Absolute | 17.4 | | | 30.8 | | | (T = 22.0 ms) | | |
| | 31.3 | | | | -1.18 | | (T = 37.9 ms) | | |

| CASE METHOD | | | | | | | | | | |
|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| J = | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| RP | 739.5 | 662.5 | 585.5 | 508.5 | 431.5 | 354.5 | 277.5 | 200.4 | 123.4 | 46.4 |
| RX | 740.8 | 664.5 | 591.4 | 546.6 | 507.3 | 485.1 | 463.2 | 442.8 | 422.6 | 408.5 |
| RU | 758.3 | 683.1 | 608.0 | 532.8 | 457.7 | 382.6 | 307.4 | 232.3 | 157.1 | 82.0 |

RAU = 280.5 (kips); RA2 = 514.3 (kips)

Current CAPWAP Ru = 463.7 (kips); Corresponding J(RP)= 0.36; J(RX) = 0.60

| VMX ft/s | TVP ms | VT1*Z kips | FT1 kips | FMX kips | DMX in | DFN in | SET in | EMX kip-ft | QUS kips |
|----------|--------|------------|----------|----------|--------|--------|--------|------------|----------|
| 16.02 | 20.92 | 746.1 | 763.5 | 764.9 | 0.513 | 0.111 | 0.111 | 21.8 | 839.4 |

| PILE PROFILE AND PILE MODEL | | | | | | | | | |
|-----------------------------|--|------------------------|--|----------------------|--|---------------------------------|--|-----------|--|
| Depth ft | | Area in ² | | E-Modulus ksi | | Spec. Weight lb/ft ³ | | Perim. ft | |
| 0.00 | | 26.10 | | 29992.2 | | 492.000 | | 4.754 | |
| 45.25 | | 26.10 | | 29992.2 | | 492.000 | | 4.754 | |
| Toe Area | | 1.411 ft ² | | | | | | | |
| Top Segment Length | | 3.48 ft, Top Impedance | | 46.59 kips/ft/s | | | | | |
| Pile Damping | | 1.0 %, Time Incr | | 0.207 ms, Wave Speed | | 16807.9 ft/s, 2L/c | | 5.4 ms | |

SARASOTA COUNTY STROKE PILE DRIVING RECORD

Pile # 2 Time: Start/stop END 4:30 Date: SEPT 4
 Project: Gulfport BRO 1442(36) Location: ABOT #2
 Pile Type/size HP 14x89 Length: Batter: None
 Elevation: Ground Pile Tip:
 Hammer Type/Size APE D19-42 Throttle Setting: 2
 Cap/Helmet/Cushion: Monocast MC-904(P)
 Contractor: Renaud Bros. Inc Pile Length: Cutoff: Pay length:

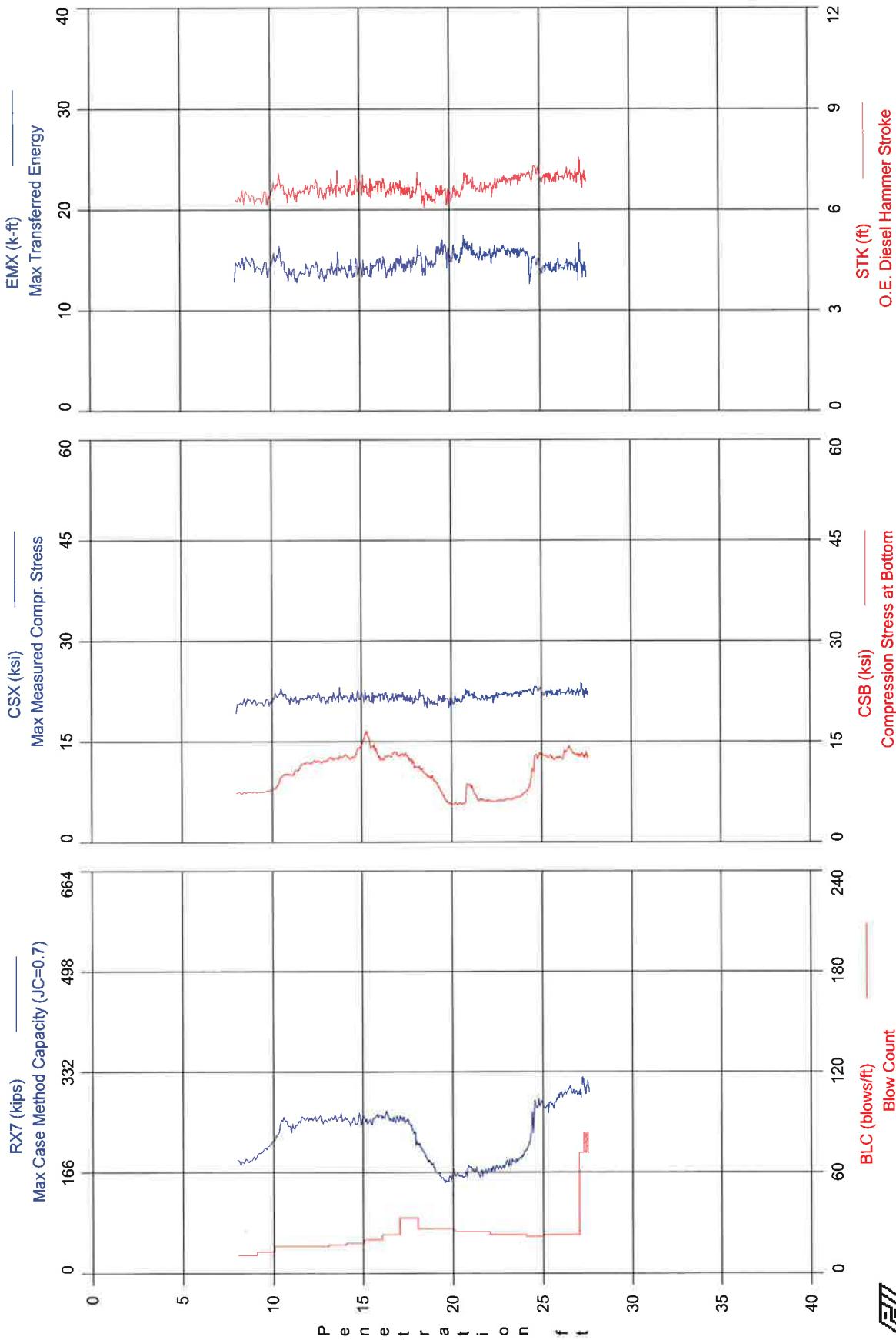
| Depth ft | Blow/ft ft | H BPM |
|-------------|---------------|----------|-------------|---------------|----------|-------------|---------------|----------|-------------|---------------|----------|
| 0-1 | | | 25-26 | 22 | 6.9 | 50-51 | | | | | |
| 1-2 | | | 26-27 | 24 | 6.8 | 51-52 | | | | | |
| 2-3 | | | 27-28 | 30 | 6.6 | 52-53 | | | | | |
| 3-4 | | | 28-29 | 33 | 6.8 | 53-54 | | | | | |
| 4-5 | 8 | 5.4 | 29-30 | 30 | 6.8 | 54-55 | | | | | |
| 5-6 | 11 | 5.4 | 30-31 | 36 | 7.1 | 55-56 | | | | | |
| 6-7 | 13 | 5.9 | 31-32 | 34 | 7.0 | 56-57 | | | | | |
| 7-8 | 11 | 5.5 | 32-33 | 37 | 7.0 | 57-58 | | | | | |
| 8-9 | 12 | 5.6 | 33-34 | 37 | 7.1 | 58-59 | | | | | |
| 9-10 | 13 | 5.8 | 34-35 | | | 59-60 | | | | | |
| 10-11 | 15 | 5.5 | 35-36 | | | 60-61 | | | | | |
| 11-12 | 15 | 5.6 | 36-37 | | | 61-62 | | | | | |
| 12-13 | 15 | 5.8 | 37-38 | | | 62-63 | | | | | |
| 13-14 | 14 | 6.0 | 38-39 | | | 63-64 | | | | | |
| 14-15 | 15 | 6.4 | 39-40 | | | 64-65 | | | | | |
| 15-16 | 19 | 6.4 | 40-41 | | | 65-66 | | | | | |
| 16-17 | 17 | 6.5 | 41-42 | | | 66-67 | | | | | |
| 17-18 | 20 | 6.5 | 42-43 | | | 67-68 | | | | | |
| 18-19 | 20 | 6.5 | 43-44 | | | 68-69 | | | | | |
| 19-20 | 25 | 6.5 | 44-45 | | | 69-70 | | | | | |
| 20-21 | 35 | 6.8 | 45-46 | | | 70-71 | | | | | |
| 21-22 | 29 | 6.9 | 46-47 | | | 71-72 | | | | | |
| 22-23 | 30 | 6.8 | 47-48 | | | 72-73 | | | | | |
| 23-24 | 23 | 6.9 | 48-49 | | | 73-74 | | | | | |
| 24-25 | 24 | 6.9 | 49-50 | | | 74-75 | | | | | |

| Remarks | Depth | Min | Interruption Reason |
|---------|-------|-----|---------------------|
| | | | |
| | | | |
| | | | |
| | | | |

blow/inch

| | | | | | | | |
|---|-----|---|-----|--|--|--|--|
| 4 | | 6 | | | | | |
| 4 | | 6 | | | | | |
| 3 | 7.1 | 8 | 7.0 | | | | |

GUILFORD BRO 1442(36) - ABUTMENT 1 PILE 5 ID -APE D19-42 (HP14X89)



GUILFORD BRO 1442(36) - ABUTMENT 1 PILE 5 ID
OP: CAG

APE D19-42 (HP14X89)
Test date: 4-Sep-2014

AR: 26.10 in²
LE: 55.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.35

| RX7: Max Case Method Capacity (JC=0.7) | | | | EMX: | Max Transferred Energy | | | |
|--|--|--|--|------|--------------------------------|--|--|--|
| CSX: Max Measured Compr. Stress | | | | STK: | O.E. Diesel Hammer Stroke | | | |
| CSB: Compression Stress at Bottom | | | | FVP: | Force/Velocity proportionality | | | |

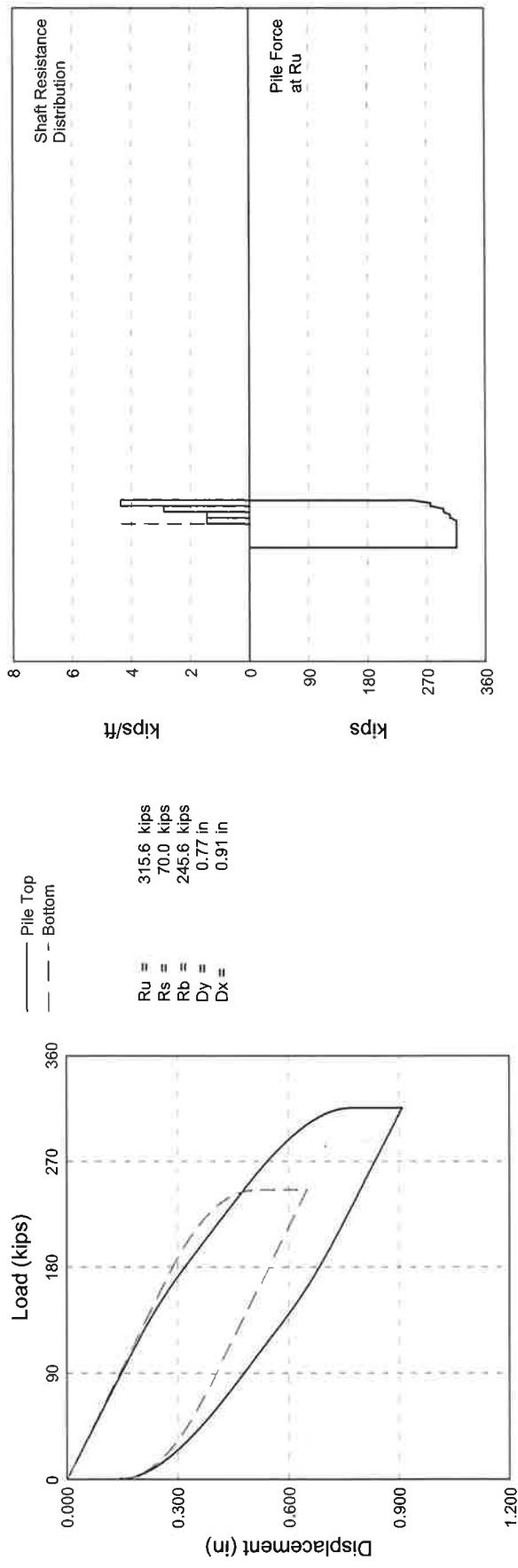
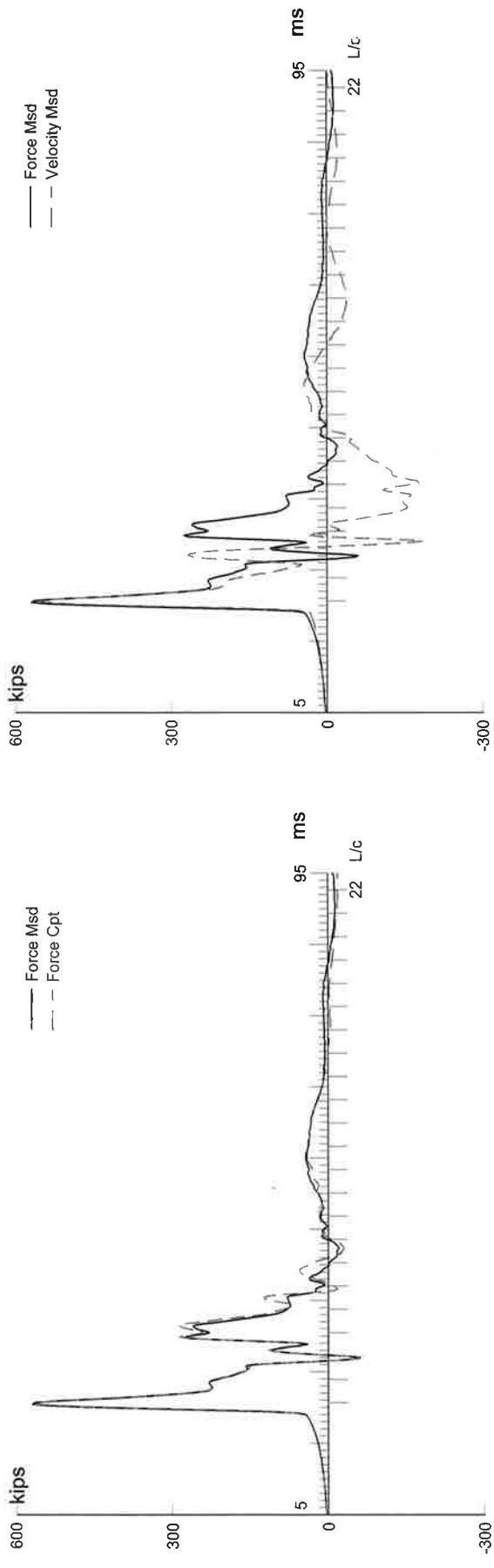
| BL# | depth | BLC | TYPE | RX7 | CSX | CSB | EMX | STK | FVP |
|-----|-------|-------|------|------|------|------|------|------|------|
| end | ft | bl/ft | | kips | ksi | ksi | k-ft | ft | [] |
| 12 | 9.00 | 11 | AV12 | 186 | 20.7 | 7.4 | 14.5 | 6.35 | 0.99 |
| 25 | 10.00 | 13 | AV13 | 205 | 20.8 | 7.6 | 14.1 | 6.32 | 0.99 |
| 41 | 11.00 | 16 | AV16 | 241 | 21.7 | 9.3 | 14.7 | 6.65 | 0.99 |
| 57 | 12.00 | 16 | AV16 | 250 | 21.3 | 11.1 | 13.6 | 6.51 | 0.99 |
| 73 | 13.00 | 16 | AV16 | 254 | 21.5 | 12.0 | 13.9 | 6.61 | 0.99 |
| 90 | 14.00 | 17 | AV17 | 256 | 21.6 | 12.5 | 14.0 | 6.63 | 0.98 |
| 108 | 15.00 | 18 | AV18 | 252 | 21.6 | 13.1 | 14.0 | 6.65 | 0.99 |
| 128 | 16.00 | 20 | AV20 | 254 | 21.6 | 14.6 | 14.1 | 6.67 | 0.98 |
| 151 | 17.00 | 23 | AV23 | 255 | 21.5 | 12.8 | 14.2 | 6.65 | 0.98 |
| 184 | 18.00 | 33 | AV33 | 244 | 21.5 | 12.6 | 14.6 | 6.61 | 0.98 |
| 237 | 20.00 | 27 | AV53 | 175 | 21.1 | 8.8 | 15.1 | 6.49 | 0.99 |
| 287 | 22.00 | 25 | AV50 | 166 | 21.5 | 6.6 | 15.7 | 6.65 | 0.99 |
| 333 | 24.00 | 23 | AV46 | 180 | 22.0 | 6.4 | 15.7 | 6.84 | 0.99 |
| 355 | 25.00 | 22 | AV21 | 251 | 22.7 | 10.6 | 15.1 | 7.10 | 0.99 |
| 378 | 26.00 | 23 | AV23 | 281 | 22.2 | 12.7 | 14.2 | 6.96 | 0.99 |
| 401 | 27.00 | 23 | AV23 | 299 | 22.3 | 13.3 | 14.4 | 7.03 | 0.99 |
| 407 | 27.08 | 72 | AV6 | 299 | 22.3 | 12.9 | 14.4 | 7.01 | 0.98 |
| 413 | 27.17 | 72 | AV4 | 295 | 22.5 | 13.0 | 14.2 | 7.09 | 0.99 |
| 419 | 27.25 | 72 | AV6 | 317 | 23.2 | 13.1 | 15.6 | 7.28 | 0.99 |
| 426 | 27.33 | 84 | AV7 | 310 | 22.6 | 13.0 | 14.7 | 7.07 | 0.99 |
| 432 | 27.42 | 72 | AV6 | 302 | 22.1 | 12.8 | 13.9 | 6.88 | 0.99 |
| 439 | 27.50 | 84 | AV7 | 312 | 22.5 | 13.1 | 14.5 | 7.06 | 0.99 |
| 445 | 27.58 | 72 | AV6 | 305 | 22.1 | 12.7 | 13.9 | 6.92 | 0.99 |

Time Summary

Drive 17 minutes 34 seconds 6:03:03 PM - 6:20:37 PM (9/4/2014) BN 1 - 446

GUILFORD BRO 1442(36); Pile: ABUTMENT 1 PILE 5 ID; APE D19-42 (HP14X89); Blow: 445 (Test: 04-Sep-2014 18:20);
GZA GeoEnvironmental Inc.

08-Sep-2014
CAPWAP(R) 2006-3



GUILFORD BRO 1442(36) ; Pile: ABUTMENT 1 PILE 5 ID
 APE D19-42 (HP14X89) ; Blow: 445
 GZA GeoEnvironmental Inc.

Test: 04-Sep-2014 18:20:
 CAPWAP(R) 2006-3
 OP: CAG

| CAPWAP SUMMARY RESULTS | | | | | | | | | | | |
|----------------------------------|----------------------|----------------------|---|--------------------|----------------|------------------------------|-------------------------|---------------------------|--|--|--|
| Total CAPWAP Capacity: | | | 315.6; along Shaft | | 70.0; at Toe | | 245.6 kips | | | | |
| Soil Sgmnt No. | Dist. Below Gages ft | Depth Below Grade ft | Ru in Pile kips | Force in Pile kips | Sum of Ru kips | Unit Resist. (Depth) kips/ft | Unit Resist. (Area) ksf | Smith Damping Factor s/ft | | | |
| | | | | 315.6 | | | | | | | |
| 1 | 34.4 | 6.9 | 10.0 | 305.6 | 10.0 | 1.45 | 0.31 | 0.204 | | | |
| 2 | 41.3 | 13.8 | 10.0 | 295.6 | 20.0 | 1.45 | 0.31 | 0.204 | | | |
| 3 | 48.1 | 20.6 | 20.0 | 275.6 | 40.0 | 2.91 | 0.62 | 0.204 | | | |
| 4 | 55.0 | 27.5 | 30.0 | 245.6 | 70.0 | 4.36 | 0.94 | 0.204 | | | |
| Avg. Shaft | | | 17.5 | | | 2.55 | 0.55 | 0.204 | | | |
| Toe | | | 245.6 | | | | 180.44 | 0.040 | | | |
| Soil Model Parameters/Extensions | | | | | Shaft | Toe | | | | | |
| Quake | (in) | | | | 0.140 | 0.390 | | | | | |
| Case Damping Factor | | | | | 0.307 | 0.211 | | | | | |
| Damping Type | | | | | | Smith | | | | | |
| Unloading Quake | (% of loading quake) | | | | 100 | 30 | | | | | |
| Reloading Level | (% of Ru) | | | | 100 | 100 | | | | | |
| Unloading Level | (% of Ru) | | | | 44 | | | | | | |
| Soil Plug Weight | (kips) | | | | | 0.05 | | | | | |
| CAPWAP match quality | = | 3.02 | (Wave Up Match) ; RSA = 0 | | | | | | | | |
| Observed: final set | = | 0.143 in; | blow count = 84 b/ft | | | | | | | | |
| Computed: final set | = | 0.179 in; | blow count = 67 b/ft | | | | | | | | |
| max. Top Comp. Stress | = | 21.7 ksi | (T= 21.1 ms, max= 1.044 x Top) | | | | | | | | |
| max. Comp. Stress | = | 22.7 ksi | (Z= 34.4 ft, T= 22.9 ms) | | | | | | | | |
| max. Tens. Stress | = | -2.54 ksi | (Z= 41.3 ft, T= 39.9 ms) | | | | | | | | |
| max. Energy (EMX) | = | 12.9 kip-ft; | max. Measured Top Displ. (DMX)= 0.59 in | | | | | | | | |

GUILFORD BRO 1442(36); Pile: ABUTMENT 1 PILE 5 ID
APE D19-42 (HP14X89); Blow: 445
GZA GeoEnvironmental Inc.

Test: 04-Sep-2014 18:20:
CAPWAP(R) 2006-3
OP: CAG

| EXTREMA TABLE | | | | | | | | | |
|----------------|----------------------|-----------------|-----------------|-----------------------|-----------------------|----------------------------|------------------|----------------|--|
| Pile Sgmnt No. | Dist. Below Gages ft | max. Force kips | min. Force kips | max. Comp. Stress ksi | max. Tens. Stress ksi | max. Trnsfd. Energy kip-ft | max. Veloc. ft/s | max. Displ. in | |
| 1 | 3.4 | 567.3 | -59.0 | 21.7 | -2.26 | 12.90 | 11.8 | 0.581 | |
| 2 | 6.9 | 567.9 | -56.4 | 21.8 | -2.16 | 12.81 | 11.8 | 0.571 | |
| 3 | 10.3 | 568.4 | -61.4 | 21.8 | -2.35 | 12.68 | 11.8 | 0.558 | |
| 4 | 13.8 | 568.9 | -55.1 | 21.8 | -2.11 | 12.53 | 11.8 | 0.545 | |
| 5 | 17.2 | 569.5 | -40.4 | 21.8 | -1.55 | 12.38 | 11.8 | 0.531 | |
| 6 | 20.6 | 570.2 | -44.5 | 21.8 | -1.70 | 12.27 | 11.8 | 0.520 | |
| 7 | 24.1 | 572.0 | -47.0 | 21.9 | -1.80 | 12.16 | 11.7 | 0.508 | |
| 8 | 27.5 | 577.6 | -47.2 | 22.1 | -1.81 | 12.06 | 11.6 | 0.497 | |
| 9 | 30.9 | 584.5 | -47.4 | 22.4 | -1.82 | 11.95 | 11.5 | 0.485 | |
| 10 | 34.4 | 592.5 | -59.7 | 22.7 | -2.29 | 11.81 | 11.3 | 0.472 | |
| 11 | 37.8 | 567.4 | -60.4 | 21.7 | -2.31 | 10.79 | 11.1 | 0.459 | |
| 12 | 41.3 | 578.5 | -66.3 | 22.2 | -2.54 | 10.64 | 10.9 | 0.445 | |
| 13 | 44.7 | 542.8 | -61.7 | 20.8 | -2.36 | 9.65 | 12.0 | 0.432 | |
| 14 | 48.1 | 488.1 | -62.9 | 18.7 | -2.41 | 9.50 | 14.2 | 0.419 | |
| 15 | 51.6 | 317.9 | -45.8 | 12.2 | -1.76 | 7.60 | 15.5 | 0.406 | |
| 16 | 55.0 | 303.0 | -36.9 | 11.6 | -1.41 | 5.26 | 15.4 | 0.392 | |
| Absolute | 34.4 | | 22.7 | | | | (T = 22.9 ms) | | |
| | 41.3 | | | | -2.54 | | (T = 39.9 ms) | | |

| CASE METHOD | | | | | | | | | | |
|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| J = | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| RP | 404.4 | 331.0 | 257.6 | 184.2 | 110.7 | 37.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| RX | 411.4 | 350.0 | 343.1 | 336.2 | 329.3 | 322.4 | 315.5 | 308.5 | 301.6 | 294.7 |
| RU | 411.0 | 338.3 | 265.6 | 192.9 | 120.2 | 47.4 | 0.0 | 0.0 | 0.0 | 0.0 |

RAU = 260.6 (kips); RA2 = 306.5 (kips)

Current CAPWAP Ru = 315.6 (kips); Corresponding J(RP) = 0.12; J(RX) = 0.60

| VMX ft/s | TVP ms | VT1*Z kips | FT1 kips | FMX kips | DMX in | DFN in | SET in | EMX kip-ft | QUS kips |
|----------|--------|------------|----------|----------|--------|--------|--------|------------|----------|
| 12.09 | 20.86 | 559.2 | 579.4 | 579.4 | 0.586 | 0.143 | 0.143 | 13.0 | 428.7 |

PILE PROFILE AND PILE MODEL

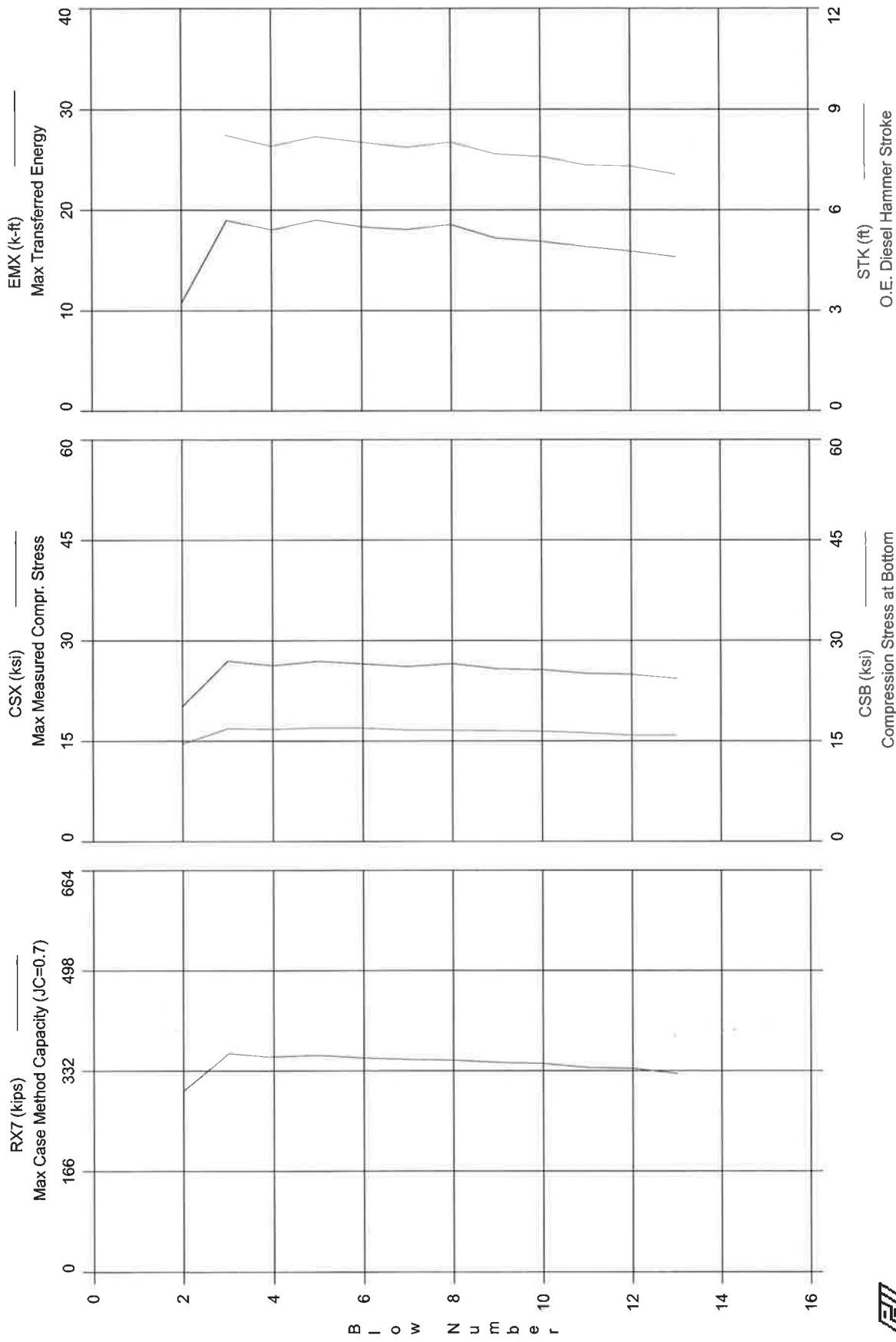
| Depth ft | Area in ² | E-Modulus ksi | Spec. Weight lb/ft ³ | Perim. ft |
|----------|----------------------|---------------|---------------------------------|-----------|
| 0.00 | 26.10 | 29992.2 | 492.000 | 4.667 |
| 55.00 | 26.10 | 29992.2 | 492.000 | 4.667 |

Toe Area 1.361 ft²

Top Segment Length 3.44 ft, Top Impedance 46.59 kips/ft/s

Pile Damping 1.0 %, Time Incr 0.205 ms, Wave Speed 16807.9 ft/s, 2L/c 6.5 ms

GUILFORD BRO 1442(36) - ABUTMENT 1 PILE 5 RS - APE D19-42 (HP14X89)



GUILFORD BRO 1442(36) - ABUTMENT 1 PILE 5 RS
OP: JAH

APE D19-42 (HP14X89)
Test date: 5-Sep-2014

AR: 26.10 in²
LE: 55.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.50

| | |
|--|-------------------------------------|
| RX7: Max Case Method Capacity (JC=0.7) | EMX: Max Transferred Energy |
| CSX: Max Measured Compr. Stress | STK: O.E. Diesel Hammer Stroke |
| CSB: Compression Stress at Bottom | FVP: Force/Velocity proportionality |

| BL# | RX7 kips | CSX ksi | CSB ksi | EMX k-ft | STK ft | FVP [] |
|---------|-------------|------------|------------|-------------|-----------|-----------|
| 2 | 299 | 20.2 | 14.6 | 10.7 | 0.00 | 0.99 |
| 3 | 362 | 26.9 | 16.9 | 19.0 | 8.23 | 0.98 |
| 4 | 355 | 26.3 | 16.8 | 18.0 | 7.91 | 0.98 |
| 5 | 358 | 26.9 | 17.0 | 19.0 | 8.19 | 0.98 |
| 6 | 353 | 26.5 | 16.9 | 18.3 | 8.03 | 0.98 |
| 7 | 351 | 26.1 | 16.7 | 18.0 | 7.87 | 0.98 |
| 8 | 350 | 26.6 | 16.6 | 18.5 | 8.03 | 0.98 |
| 9 | 346 | 25.8 | 16.6 | 17.2 | 7.68 | 0.98 |
| 10 | 344 | 25.6 | 16.5 | 16.9 | 7.60 | 0.98 |
| 11 | 337 | 25.1 | 16.2 | 16.3 | 7.35 | 0.98 |
| 12 | 336 | 24.9 | 15.9 | 15.9 | 7.32 | 0.98 |
| 13 | 327 | 24.3 | 15.9 | 15.3 | 7.08 | 0.98 |
| Average | 343 | 25.4 | 16.4 | 16.9 | 7.75 | 0.98 |

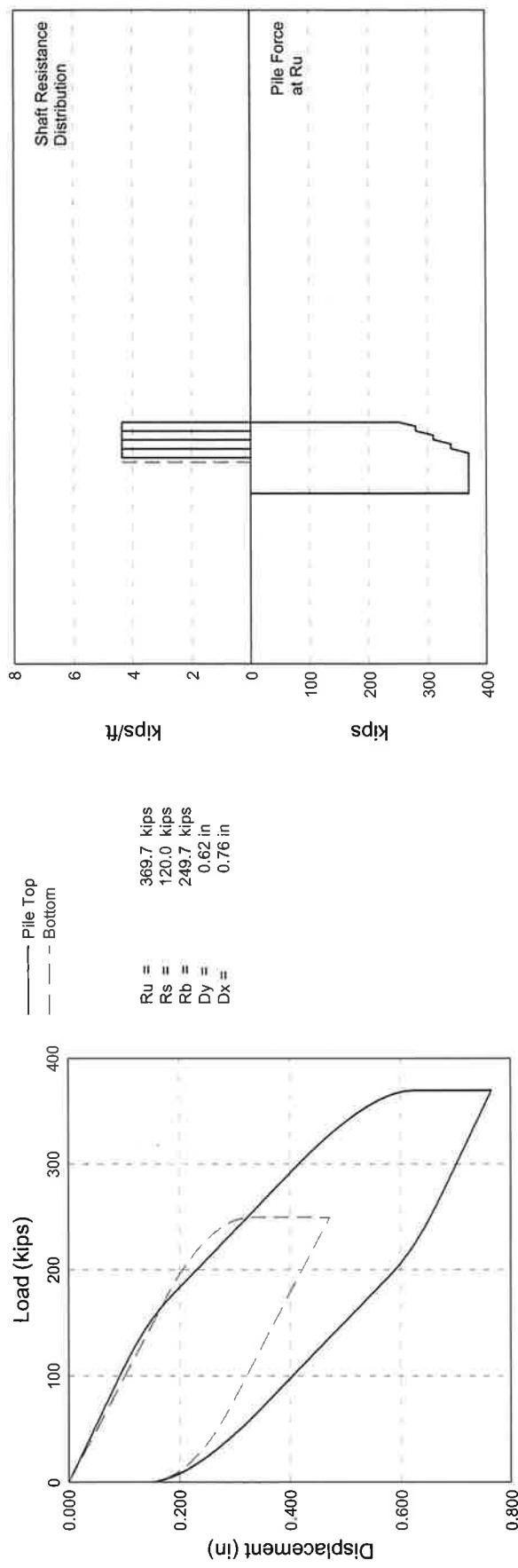
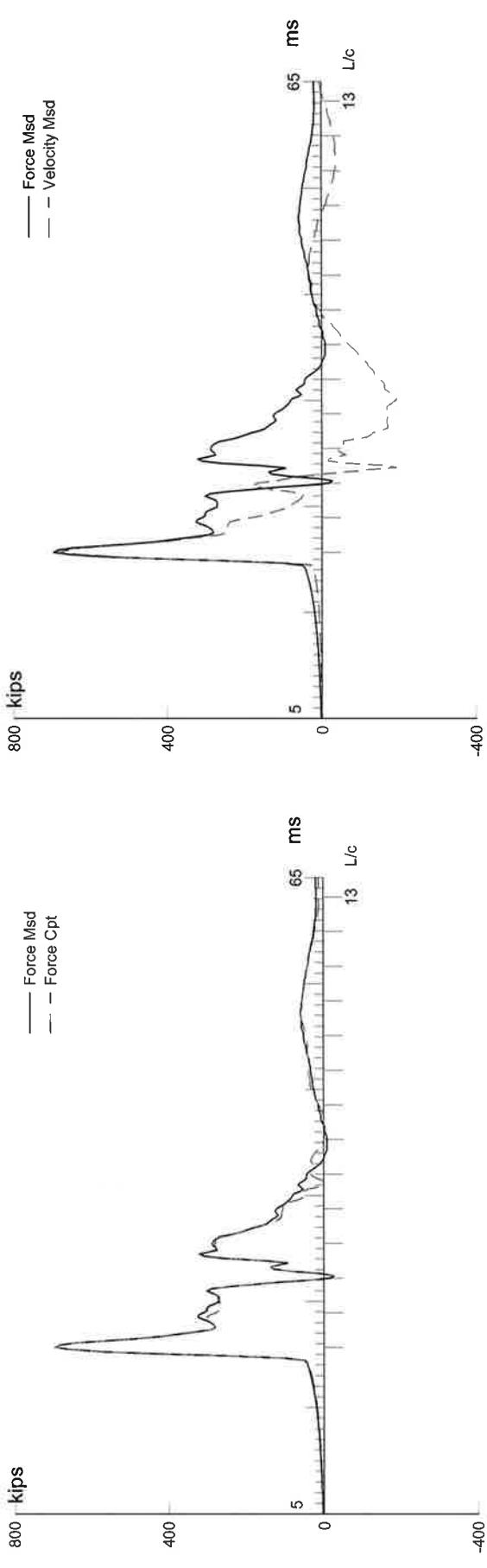
Total number of blows analyzed: 12

Time Summary

Drive 45 seconds 12:32:32 PM - 12:33:17 PM (9/5/2014) BN 1 - 14

GUILFORD BRO 1442(36); Pile: ABUTMENT 1 PILE 5 RS; APE D19-42 (HP14X89); Blow: 3 (Test: 05-Sep-2014 12:33);
 GZA GeoEnvironmental Inc.

08-Sep-2014
 CAPWAP(R) 2006-3



GUILFORD BRO 1442(36); Pile: ABUTMENT 1 PILE 5 RS
APE D19-42 (HP14X89); Blow: 3
GZA GeoEnvironmental Inc.

Test: 05-Sep-2014 12:33:
CAPWAP(R) 2006-3
OP: JAH

| CAPWAP SUMMARY RESULTS | | | | | | | | |
|---|----------------------|----------------------|--------------------------------|--------------------|----------------|------------------------------|-------------------------|---------------------------|
| Total CAPWAP Capacity: | | | 369.7; along Shaft | | 120.0; at Toe | | 249.7 kips | |
| Soil Sgmnt No. | Dist. Below Gages ft | Depth Below Grade ft | Ru kips | Force in Pile kips | Sum of Ru kips | Unit Resist. (Depth) kips/ft | Unit Resist. (Area) ksf | Smith Damping Factor s/ft |
| | | | | 369.7 | | | | |
| 1 | 34.4 | 7.0 | 30.0 | 339.7 | 30.0 | 4.31 | 0.91 | 0.201 |
| 2 | 41.3 | 13.8 | 30.0 | 309.7 | 60.0 | 4.36 | 0.92 | 0.201 |
| 3 | 48.1 | 20.7 | 30.0 | 279.7 | 90.0 | 4.36 | 0.92 | 0.201 |
| 4 | 55.0 | 27.6 | 30.0 | 249.7 | 120.0 | 4.36 | 0.92 | 0.201 |
| Avg. Shaft | | | 30.0 | | | 4.35 | 0.92 | 0.201 |
| Toe | | | 249.7 | | | | 176.92 | 0.050 |
| Soil Model Parameters/Extensions | | | | | | | | |
| Quake | (in) | | | | 0.045 | 0.253 | | |
| Case Damping Factor | | | | | 0.517 | 0.270 | | |
| Damping Type | | | | | | Smith | | |
| Unloading Quake | (% of loading quake) | | | | 79 | 43 | | |
| Reloading Level | (% of Ru) | | | | 100 | 100 | | |
| Unloading Level | (% of Ru) | | | | 5 | | | |
| Resistance Gap (included in Toe Quake) (in) | | | | | | 0.008 | | |
| Soil Plug Weight | (kips) | | | | | 0.15 | | |
| CAPWAP match quality | = | 1.87 | (Wave Up Match) ; RSA = 0 | | | | | |
| Observed: final set | = | 0.143 in; | blow count | = | 84 b/ft | | | |
| Computed: final set | = | 0.168 in; | blow count | = | 71 b/ft | | | |
| max. Top Comp. Stress | = | 26.8 ksi | (T= 21.1 ms, max= 1.091 x Top) | | | | | |
| max. Comp. Stress | = | 29.2 ksi | (Z= 34.4 ft, T= 23.1 ms) | | | | | |
| max. Tens. Stress | = | -2.17 ksi | (Z= 34.4 ft, T= 40.9 ms) | | | | | |
| max. Energy (EMX) | = | 18.8 kip-ft; | max. Measured Top Displ. (DMX) | = | 0.56 in | | | |

GUILFORD BRO 1442(36); Pile: ABUTMENT 1 PILE 5 RS
APE D19-42 (HP14X89); Blow: 3
GZA GeoEnvironmental Inc.

Test: 05-Sep-2014 12:33:
CAPWAP(R) 2006-3
OP: JAH

| EXTREMA TABLE | | | | | | | | | |
|----------------|----------------------|-----------------|-----------------|-----------------------|-----------------------|----------------------------|------------------|----------------|--|
| Pile Sgmnt No. | Dist. Below Gages ft | max. Force kips | min. Force kips | max. Comp. Stress ksi | max. Tens. Stress ksi | max. Trnsfd. Energy kip-ft | max. Veloc. ft/s | max. Displ. in | |
| 1 | 3.4 | 699.9 | -8.6 | 26.8 | -0.33 | 18.81 | 14.5 | 0.570 | |
| 2 | 6.9 | 700.3 | -15.2 | 26.8 | -0.58 | 18.78 | 14.5 | 0.565 | |
| 3 | 10.3 | 700.7 | -20.7 | 26.8 | -0.79 | 18.70 | 14.5 | 0.556 | |
| 4 | 13.8 | 701.6 | -26.6 | 26.9 | -1.02 | 18.57 | 14.4 | 0.543 | |
| 5 | 17.2 | 702.7 | -33.0 | 26.9 | -1.26 | 18.39 | 14.4 | 0.528 | |
| 6 | 20.6 | 703.7 | -39.0 | 27.0 | -1.49 | 18.17 | 14.4 | 0.512 | |
| 7 | 24.1 | 705.2 | -45.0 | 27.0 | -1.72 | 17.93 | 14.3 | 0.494 | |
| 8 | 27.5 | 719.1 | -50.1 | 27.5 | -1.92 | 17.66 | 14.0 | 0.476 | |
| 9 | 30.9 | 744.3 | -52.5 | 28.5 | -2.01 | 17.40 | 13.4 | 0.458 | |
| 10 | 34.4 | 763.4 | -56.5 | 29.2 | -2.17 | 17.17 | 13.0 | 0.441 | |
| 11 | 37.8 | 681.3 | -49.5 | 26.1 | -1.90 | 14.25 | 12.4 | 0.425 | |
| 12 | 41.3 | 701.8 | -48.7 | 26.9 | -1.86 | 14.04 | 12.0 | 0.409 | |
| 13 | 44.7 | 620.7 | -38.8 | 23.8 | -1.49 | 11.34 | 11.6 | 0.393 | |
| 14 | 48.1 | 594.7 | -38.7 | 22.8 | -1.48 | 11.16 | 14.1 | 0.378 | |
| 15 | 51.6 | 383.6 | -29.7 | 14.7 | -1.14 | 8.47 | 15.6 | 0.364 | |
| 16 | 55.0 | 350.7 | -27.7 | 13.4 | -1.06 | 6.27 | 15.9 | 0.350 | |
| Absolute | 34.4 | | | 29.2 | | | (T = 23.1 ms) | | |
| | 34.4 | | | | -2.17 | | (T = 40.9 ms) | | |

| CASE METHOD | | | | | | | | | | |
|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| J = | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| RP | 601.2 | 521.8 | 442.4 | 363.0 | 283.6 | 204.1 | 124.7 | 45.3 | 0.0 | 0.0 |
| RX | 601.9 | 529.7 | 462.2 | 421.8 | 406.0 | 394.9 | 385.5 | 376.1 | 366.8 | 357.4 |
| RU | 601.2 | 521.8 | 442.4 | 363.0 | 283.6 | 204.1 | 124.7 | 45.3 | 0.0 | 0.0 |

RAU = 289.5 (kips); RA2 = 430.2 (kips)

Current CAPWAP Ru = 369.7 (kips); Corresponding J(RP) = 0.29; J(RX) = 0.77

| VMX ft/s | TVP ms | VT1*Z kips | FT1 kips | FMX kips | DMX in | DFN in | SET in | EMX kip-ft | QUS kips |
|----------|--------|------------|----------|----------|--------|--------|--------|------------|----------|
| 14.86 | 20.86 | 692.0 | 703.3 | 703.3 | 0.559 | 0.143 | 0.143 | 18.8 | 643.6 |

| PILE PROFILE AND PILE MODEL | | | | | |
|-----------------------------|----------------------|---------------|---------------------------------|-----------|--|
| Depth ft | Area in ² | E-Modulus ksi | Spec. Weight lb/ft ³ | Perim. ft | |
| 0.00 | 26.10 | 29992.2 | 492.000 | 4.754 | |
| 55.00 | 26.10 | 29992.2 | 492.000 | 4.754 | |

Toe Area 1.411 ft²

Top Segment Length 3.44 ft, Top Impedance 46.59 kips/ft/s

Pile Damping 1.0 %, Time Incr 0.205 ms, Wave Speed 16807.9 ft/s, 2L/c 6.5 ms

SAXIMETER BLOW COUNT/STROKE PILE DRIVING RECORD

Pile # 5 Time: Start/stop 5:20 - 6:20 Date: 9/3/14
 Project Guilford BRO 1442(36) Location ABUT Z
 Pile Type/size HP 14x89 Length Batter None
 Elevation: Ground Pile Tip
 Hammer Type/Size APE D19-42 Throttle Setting: 2
 Cap/Helmet/Cushion Monocast MC-904(P)
 Contractor Renaud Bros, Inc Pile Length Cutoff: Pay length

| Depth ft | Blow/ft ft | H BPM |
|-------------|---------------|----------|-------------|---------------|----------|-------------|---------------|----------|-------------|---------------|----------|
| 0-1 | | | 25-26 | 23 | 6.7 | 50-51 | | | | | |
| 1-2 | | | 26-27 | 23 | 6.9 | 51-52 | | | | | |
| 2-3 | | | 27-28 | | | 52-53 | | | | | |
| 3-4 | | | 28-29 | | | 53-54 | | | | | |
| 4-5 | | | 29-30 | | | 54-55 | | | | | |
| 5-6 | | | 30-31 | | | 55-56 | | | | | |
| 6-7 | | | 31-32 | | | 56-57 | | | | | |
| 7-8 | 14 | 5.5 | 32-33 | | | 57-58 | | | | | |
| 8-9 | 15 | 5.6 | 33-34 | | | 58-59 | | | | | |
| 9-10 | 13 | 5.6 | 34-35 | | | 59-60 | | | | | |
| 10-11 | 16 | 5.5 | 35-36 | | | 60-61 | | | | | |
| 11-12 | 16 | 5.7 | 36-37 | | | 61-62 | | | | | |
| 12-13 | 16 | 5.8 | 37-38 | | | 62-63 | | | | | |
| 13-14 | 17 | 6.0 | 38-39 | | | 63-64 | | | | | |
| 14-15 | 18 | 6.3 | 39-40 | | | 64-65 | | | | | |
| 15-16 | 20 | 6.4 | 40-41 | | | 65-66 | | | | | |
| 16-17 | 23 | 6.4 | 41-42 | | | 66-67 | | | | | |
| 17-18 | 23 | 6.6 | 42-43 | | | 67-68 | | | | | |
| 18-19 | 53 | 6.8 | 43-44 | | | 68-69 | | | | | |
| 19-20 | 50 | 6.7 | 44-45 | | | 69-70 | | | | | |
| 20-21 | 46 | 6.5 | 45-46 | | | 70-71 | | | | | |
| 21-22 | | | 46-47 | | | 71-72 | | | | | |
| 22-23 | | | 47-48 | | | 72-73 | | | | | |
| 23-24 | | | 48-49 | | | 73-74 | | | | | |
| 24-25 | 22 | 6.7 | 49-50 | | | 74-75 | | | | | |

| Remarks | Depth | Min | Interruption Reason |
|---------|-------|-----|---------------------|
| | | | |
| | | | |
| | | | |
| | | | |

blow/inch

| | | | | | | | |
|----|-----|---|-----|---|-----|--|--|
| 6 | 7.0 | 7 | 7.0 | 6 | 7.0 | | |
| 10 | 7.0 | 6 | 7.0 | | | | |
| 6 | 7.0 | 7 | 7.0 | | | | |